A STUDY OF LEACHATE GENERATED FROM CONSTRUCTION AND DEMOLITION LANDFILLS

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CONTENTS

CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Construction and demolition (C&D) waste landfills have largely been ignored because they have been viewed as innocuous in comparison to municipal solid waste (MSW) landfills and hazardous waste landfills. Regulators felt that since C&D landfills did not accept large quantities of hazardous waste and the waste was relatively stable in comparison to MSW, these landfills did not pose a threat to the environment. Thus, little is known about leachate generated from C&D landfills because they have not been well studied.

Based on the results of a statistical analysis, the following parameters in C&D leachate could present a risk to human health and the environment because they exceed either primary groundwater standards, secondary groundwater standards, or guidance concentrations for groundwater:

Methylene Chloride	*1,2-Dichloroethane*	*Cadmium*	*Lead*
Iron	*Total Dissolved Solids*	*Manganese*	*Sulfate*

Some degradation of groundwater could occur because of the presence of these contaminants. It cannot be determined how far the contaminants will spread from a disposal site. There is a high probability groundwater monitoring wells will contain iron, manganese, and total dissolved solids in excess of the groundwater standards because of the extremely high levels of these contaminants in C&D leachate. It cannot be determined if the remaining parameters will be found in groundwater monitoring wells above the applicable standards.

Standards for C&D landfills should include financial assurance, groundwater monitoring, corrective action, and location restrictions similar to the standards applicable to MSW landfills. Because of the risk for damage to human health and the environment, C&D landfills should be required to prove that they have the financial resources to mitigate any damage caused by the C&D landfill. Groundwater monitoring should be required to protect the groundwater resources, and if damage occurs, corrective action is needed to mitigate the damage. Location restrictions would protect against release of solid waste in unstable areas.

There is insufficient data concerning volatile organics, semi-volatile organics, and other organics such as pesticides and herbicides, therefore further research is required to determine if these classes of contaminants are present in sufficient amounts to endanger human health and the environment.

1.0 INTRODUCTION

1.1 Background

The proper design of a solid waste landfill includes the consideration of leachate generation and its potential impact on human health and the environment. Leachate is the liquid that has percolated through the waste in a landfill and has extracted dissolved or suspended solids from the waste (Tchobanoglous et al. 1993). Considerable research has been conducted on leachate generated from municipal solid waste (MSW) landfills, therefore, this leachate is well characterized. MSW landfills generally accept all waste generated in the community with the exception of industrial and agriculture waste (Tchobanoglous et al. 1993). Construction and Demolition (C&D) waste landfills are a special category of solid waste landfills. C&D waste landfills accept a wide variety of waste generated by construction and demolition activities. C&D waste landfills have been largely ignored because they were viewed as innocuous in comparison to MSW landfills and hazardous waste landfills. Regulators felt that since C&D waste landfills did not accept hazardous waste except for hazardous waste that could not be physically separated, and since the waste was relatively stable in comparison to MSW, these landfills posed a minimal threat to the environment. Researchers have largely ignored C&D waste landfills because of this pervasive attitude. Thus, little is known about leachate generated from C&D waste landfills because these landfills have not been well studied.

The 1984 amendments to the Resource Conservation and Recovery Act (RCRA) required the U. S. Environmental Protection Agency (EPA) to revise the existing standards governing management of household hazardous waste and hazardous waste from small quantity generators (EPA 1995). In 1991, regulators at the EPA issued revised criteria for MSW landfills that receive these two classes of hazardous waste. The revised criteria did not apply to non-MSW landfills. The EPA was subsequently sued for ignoring non-MSW landfills. The EPA has since issued proposed standards for non-MSW landfills (EPA 1995). It is anticipated that the new regulations will impact C&D waste landfills the greatest. Concurrent to EPA's proposed rule development, the State of Florida has developed rules to address the management of C&D waste in the state. Despite the new regulatory attention paid to C&D waste disposal operations, the basic question

remains: To what extent does leachate from C&D waste represent a threat to human health and the environment?

1.2 Composition of C&D Waste

This study does not focus on the composition of C&D waste, but a brief introduction is appropriate so that leachate generated from this waste can be better understood. C&D waste is defined as "all waste resulting from the construction, renovation and demolition of buildings, roads, bridges, docks, piers, and all other structures (Spencer 1991)." The definition of C&D waste also shows the many sources of C&D waste. C&D waste comes from residential, commercial, industrial, and governmental activities. The major components of C&D waste are wood products, cardboard and other paper products, concrete and asphalt, plastics, metals, roofing materials, dirt and vegetation from landclearing operations, and other miscellaneous materials including carpeting, drywall, insulation, flashing, tile, and empty containers.

Most of the waste is relatively inert, however C&D waste also contains wastes that may be hazardous (EPA 1995). The hazardous waste either cannot be removed from the non-hazardous constituents (paint, sealants), or is mixed with the C&D waste and is not identified by inspectors at the C&D waste landfills (paint cans, caulking tubes). The potentially hazardous materials can be divided into four categories: 1) excess materials and their containers, 2) waste oils, grease, and fluids, 3) other discrete items such as batteries, fluorescent bulbs, and appliances, and 4) inseparable constituents of bulk items (EPA 1995). Excess materials include paint cans with excess paint, caulking compounds, sealants, and fillers. Residual amounts of these items are often left in their containers and discarded into the dumpster. Discrete items like batteries and bulbs contain trace amounts of mercury and other heavy metals that may leach into the ground after disposal. Inseparable constituents of bulk items refer to paints, sealants, and preservatives that are applied to wood and metal surfaces. These paints and sealants cannot be removed from the bulk item once they are applied. Heavy metals and semi-volatile organic compounds are often a major constituent of these paints and sealants. These contaminants are released into water as it flows over the bulk item in a landfill. Leachate which is generated from any of these categories of C&D waste has the potential to contain harmful concentrations of the hazardous constituents found in the waste. Because these small quantities of hazardous waste are found in C&D waste, this waste can no longer be ignored and classified as innocuous.

A study of three C&D waste landfills in the Houston, Texas, area concluded that over half of the total waste stream consists of wood, brush, and grass (Norstrom et al. 1991). These wastes decompose rapidly which can cause the formation of organic acids, high oxygen demand, and high organic content in C&D leachate. Paper and cardboard made up between 2 and 13 percent. These materials will decompose less rapidly than the wood and brush. Concrete, rock, asphalt, and soil made up 15 percent of the waste. Metals made up six percent by volume of the waste. Various metals in the waste cause elevated levels of heavy metals, iron, and manganese. Rubber, plastic, and glass composed between 2 and 9 percent. Miscellaneous items such as roofing materials, carpet, insulation, and drywall composed between 4 and 19 percent of C&D waste.

The materials found at the Houston landfills are typical at C&D waste landfills. However, the percentages expressed in the study by Norstrom et al. cannot be considered to by typical of all C&D waste landfills. C&D waste composition can vary greatly depending on the bans in place, the type of industry in the area, and the dumping fees for the C&D waste landfill. One of the largest effects will be bans on landclearing debris, grass and other materials that degrade easily. When these bans are in place, the oxygen demand and nitrogen loading should decrease (Hamel 1989). Such a ban may also result in an increase in the concentration of heavy metals and other contaminants. As the amount of landclearing debris in the waste is reduced, the other types of material will make up a larger percentage of C&D waste. The increasing percentage of metals, gypsum wall board, cement and other materials will increase the amount of metals, sulfate, sodium, potassium and other contaminants in the leachate. The type of industry in the vicinity of the landfill will also affect the composition of C&D waste. For example, in an area that is rapidly expanding, a greater portion of the waste stream will come from new construction. New construction will tend to have higher concentrations of wood, gypsum board, and containers containing sealants, caulking and chemical products. If an area is fully developed, quite a bit of renovation work is expected. This could include road work. Demolition wastes from renovation can include lead-based paint, asbestos, concrete and asphalt. Demolition debris will be higher in these materials than in new construction. Thus, the type of industry in an area can significantly impact the composition of C&D waste. Finally, the fees that landfills charge can affect the composition of the waste. If two C&D waste landfills operate in the same geographical area, and

one charges significantly lower tipping fees, more of the heavy debris could end up in the landfill with the lower tipping fee. This could shift the composition in both landfills as the landfill with the higher tipping fees gets less heavy materials such as concrete, and the landfill with the lower tipping fees receiving more heavy materials.

In conclusion, the composition of C&D waste is highly variable. The specific composition will depend on the bans in place, industry in the area of the landfill, and the dump or tip fees charged at the landfill.

1.3 Scope of Project

C&D waste is a potential problem because it may contain small quantities of hazardous waste. Because of this, in the past several years C&D waste landfills have received renewed attention from state and local regulators. However, many aspects of C&D waste and C&D waste landfills are still unknown. The University of Florida recently began a project which will investigate some of the unknown aspects of C&D waste. The scope of the project includes characterizing the composition of C&D waste, conducting a full review of C&D waste landfills in the State of Florida, and investigating C&D leachate through a lysimeter study. There is limited data available on the composition of leachate generated from C&D waste landfills. A complete review of the limited data is needed to determine what components will be expected to represent a problem. This project reviews the available data on leachate generated from C&D waste landfills and presents a statistical analysis of the data. This project includes a complete literature review of the major leachate studies, a detailed description of the method taken to analyze the data, a thorough analysis of the statistical results, and conclusions and recommendations.

2.0 LITERATURE REVIEW

2.1 Introduction

There are a small number of reports and other documents that have addressed the composition of leachate from C&D waste landfills. The following sections summarize these reports and documents. The largest amount of information came from the report produced for the National Association of Demolition Contractors. However, this report only gathered, not analyzed, the data. The report produced for Waste Management Incorporated contains the most extensive round of sampling and a complete analysis of the data. As part of its rulemaking process, the EPA prepared a report that summarizes the existing database of leachate from C&D waste landfills, including the reports mentioned above.

The work presented here summarizes available leachate data from C&D waste landfills. Since many of the sources of data have been presented in many different reports, the data presented here are referenced to the original source report when possible. The data are from sources believed to be leachate, not groundwater contaminated with leachate. Such sources include leachate collection systems from lined landfills, leachate seeps, and wells within the C&D waste. The data are analyzed in a later chapter. The sampling results for all of the reports discussed in the following sections are located in Appendix A. The depth of analysis presented in this report is greater than any previous study.

2.2 The National Association of Demolition Contractors Study

The National Association of Demolition Contractors (NADC) hired the consultant firm of Gershman, Bricker & Bratton (GBB) to examine the appropriate management and/or disposal techniques for C&D waste. Because leachate quality from C&D waste landfills has never been adequately researched, GBB decided to investigate the environmental history of rubble fills or C&D waste landfills around the country. GBB sent letters to each State requesting information and data on any leachate test results submitted to the state as part of operational monitoring activities. The responses to these letters make up Volume I of the NADC report, which is entitled "Specific State-by-State Responses" (NADC 1994). The following states sent leachate data from operational C&D landfills: Colorado, Connecticut, Iowa, New York, South Carolina, and Washington. Minnesota, North Dakota, and Delaware sent groundwater monitoring results only.

The groundwater monitoring results were not included in this investigation because contaminants in the groundwater are greatly diluted from raw leachate. The diluted concentrations could skew the results of the raw leachate data, making the mean and median values for the contaminants smaller and, therefore, not representative of leachate quality. The landfills that were included in Volume I of the NADC report and had leachate quality data are given in Table 2.1. The results of these surveys are included in Appendix A.

Table 2.1: Landfills from Volume I of NADC Report

NAME OF LANDFILL	LOCATION	NO. OF LEACHATE SAMPLES
Construction Disposal Inc. Landfill	Adams County, Colorado	1
Mt. Olivet Landfill	King County, Washington	2
110 Sand Co. C&D Debris Landfill	Melville, New York	20
Blydenburg Cleanfill	Islip, New York	4
Unknown Site	South Carolina	1

Volume II of the NADC report is entitled "Copies of Reports, Articles, and Other Related Data" (NADC 1994). There are five reports not written by GBB that are included in Volume II. Because four of the five reports were written by other groups or individuals, they are reported as separate literature sources in this paper. Only the response provided by Brandywine Enterprises, Inc. is discussed in this section. Brandywine Enterprises Inc. reported leachate quality data from their C&D landfill, the Cross Trails Rubble Landfill in Maryland. They did not include any information concerning the characteristics of the landfill. Because Brandywine Enterprises reported volume of leachate collected and disposed, it is reasonable to assume that the landfill has a leachate collection system. Since landfills with leachate collection systems normally have liners, it can also be assumed that the landfill is lined. This second assumption is less certain than the first. No other information was provided by Brandywine Enterprises.

The NADC report concluded that a "vast majority of waste received by demolition landfills is relatively inert" (NADC 1994). The investigators were convinced that leachate from state-of-the-art demolition landfills and MSW landfills are not similar in concentration or composition, therefore, they should not be regulated in a similar manner. They recommend that all C&D landfills should have: 1) trained personnel who inspect all incoming waste loads for unsuitable

waste, 2) leachate containment system consisting of either suitable soil conditions, compaction of suitable soil, or other containment system, 3) groundwater monitoring system, and 4) financial assurance. The authors conclude that C&D landfills that follow these guidelines will not pose a significant threat to the environment.

2.3 Waste Management Incorporated Study

This is the report from the third year of an ongoing study conducted by Waste Management of North America (WMI) (Waste Management Inc. 1993). The purpose of the study is to characterize the composition of leachate from C&D waste landfills. WMI planned to use the results of this study to determine the type of liner needed for C&D waste landfills. The study began in 1991 and initially included four landfills: 1) an Ohio landfill owned by WMI, 2) a Kentucky landfill owned by WMI, 3) a Michigan landfill not owned by WMI, and 4) a Massachusetts landfill not owned by WMI. After the first year of sampling was completed, the investigators discovered that the Ohio landfill used steel mill slag as a granular bed within its leachate collection system. The steel mill slag significantly impacted the analytical results, therefore, the Ohio landfill was removed from the study. The investigators replaced the Ohio site with a Wisconsin landfill not owned by WMI in 1992. Sampling results from the Wisconsin site are only available for 1993.

The leachate samples from the various landfills were analyzed for Priority Pollutants, TCLP parameters, Appendix IX parameters identified in the Resource Conservation and Recovery Act (RCRA) and located in Title 40 of the Code of Federal Regulations, Part 261, and conventional parameters. The document states that the samples were analyzed for parameters identified under Appendix II of 40 CFR Part 261, however, Appendix II of Part 261 simply refers to TCLP test procedures. There is not an Appendix II list of chemicals. It is uncertain what the report was referring to as the Appendix II list. The chemicals included in Appendix IX can exist in wastes and are considered to be health hazards. According to the authors, regulatory agencies often require Appendix IX testing to determine if groundwater contamination is occurring. The Appendix II list given in the report consists of 219 chemicals. A majority of the chemicals included in Appendix II are also included in the Appendix IX list. The Priority Pollutant list was developed as part of the Clean Water Act Industrial Pretreatment Program. The investigators included these parameters in this study because they can cause problems for wastewater treatment

plants that process leachate. The Toxicity Characteristic Leaching Procedure (TCLP) replaced the EP toxicity procedure under Subtitle C of RCRA. The TCLP test is designed to more accurately predict the leaching potential of solid waste and to determine if the leachate is hazardous. The TCLP test is currently used for 39 parameters, however, the EPA is considering expanding the list to a total of 200 parameters. Although RCRA has not been changed, the investigators felt it was prudent to test for all of the parameters included on the expanded list. In total, the samples were analyzed for 253 parameters. This is by far the largest number of parameters that were sampled for in one study. The sampling results are included in Appendix A. Parameters that were detected in at least one sample from any of the landfills are included in Appendix A. If the samples were tested for a particular parameter, but the parameter was not detected in any sample, the parameter was not included in Appendix A.

Because this is an ongoing study, the investigators analyzed the data by comparing the results of the 1993 sampling rounds with the results from the previous two years. The following conclusions were presented in the Waste Management Inc. report. The investigators concluded that none of the leachate from the five C&D waste landfills would be classified as hazardous waste because all of the samples passed the current TCLP test. The number of volatile organic compounds detected increased from 3 compounds in 1992 to 8 compounds in 1993. Likewise, the number of semi-volatile compounds detected increased from 6 in 1992 to 11 in 1993. There was no trend among the pesticides, herbicides, and insecticides. The number of metals detected in 1993 remained approximately the same with arsenic, barium, chromium, lead, nickel, and zinc being detected the most frequently. The compounds detected in 1993 never exceeded the maximum contaminant levels established by the National Primary Drinking Water Standards. However, the amount of iron, zinc, total dissolved solids, and sulfates exceeded the National Drinking Water Secondary Standards at least once in 1993. Because the leachate can contain elevated levels of some contaminants, the investigators concluded that engineering controls, such as liners, leachate collection systems, and groundwater monitoring wells, should be installed at landfills which accept C&D waste.

2.4 SKB Rich Valley Demolition Waste Management Facility Study

The SKB Rich Valley Demolition Waste Management Facility is located in Inver Grove Heights, Minnesota. The Minnesota Pollution Control Agency issued a permit for landfill

operations to the facility in August 1989. As part of its closure and post closure plans, the facility was required to assess the potential damage to the environment resulting from facility operations. As a result, SKB Demolition Waste Disposal contracted Nova Environmental Services Inc. to assess the potential for environmental damage. Interpoll Laboratories was contracted to update this original study in 1992 (Interpoll Laboratories 1992).

The facility was constructed with a liner and leachate collection system. The liner was constructed of a two foot compacted clay base overlaid with a three foot protective drainage layer consisting of medium sand. The bottom layer had a maximum permeability of 1×10^{-7} cm/sec. The top layer had a minimum permeability of 5×10^{-3} cm/sec. Six inch in diameter PVC collection pipes were installed between the two layers to collect leachate. The leachate flows by gravity to collection pipes and a lift station. Leachate is collected at the lift station and transported off site for treatment at an industrial/domestic wastewater treatment plant.

The landfill has accepted only construction waste and demolition debris since opening in 1989. The waste includes concrete, brick, asphalt, stucco, rock/gravel, metal, roofing, wood and other miscellaneous materials. The facility does not accept yard wastes, liquids, septic tank pumping, vehicles, tires, machinery, appliances, fertilizers or hazardous wastes.

Eight leachate samples were obtained during the period 1990 through 1992. . The results of the sampling are included in Appendix A. The first leachate sample was analyzed for both routine and extended parameters. Routine parameters included common heavy metals, other metals, and conventional parameters. Extended parameters included carcinogenic polynuclear aromatic hydrocarbons (PAH's) such as benzo(g)pyrene and noncarcinogenic PAH's such as acenaphthene and pyrene. The remaining seven leachate samples were analyzed for routine parameters only. Table 2.2 contains a list of all parameters included in this study. Appendix A contains the complete results of these eight sampling rounds. The samples were compared to the either the recommended allowable limits (RAL's) for drinking water, maximum contaminant levels (MCL's) under the Safe Drinking Water Act, secondary maximum contaminant levels (SMCL's) under the Safe Drinking Water Act, or intervention limits. RAL's apply to private drinking water standards in Minnesota.

Chloride, total dissolved solids, iron, manganese, nitrate, and nitrite exceeded an SMCL during one or more the sampling events. The investigators believe that the high level of nitrate,

nitrite and dissolved iron contained in the Fall 1990 results are erroneous. They performed one additional sampling event in January 1991 to validate these results. The January 1991 sample indicated levels of nitrate, nitrite and dissolved iron that were much more in line with the other sampling events. Arsenic exceeded the RAL in the summer 1990 sample, but did not exceed the MCL. Methylene chloride, 1,1,1-trichloroethane, and trichlorofluoromethane were identified in the spring 1990 sample, however, they did not exceed the applicable standards. The study reported the carcinogenic and noncarcinogenic PAH's as cumulative totals only. The cumulative totals were compared to the RAL for Minnesota. The reported values for the carcinogenic and noncarcinogenic PAH's exceeded the RAL levels. Since the study did not indicate the values for individual compounds within these categories, it cannot be determined if any MCL was exceeded.

Table 2.2: Parameters Included in Study for SKB Rich Valley Waste Management Facility

ROUTINE PARAMETERS		EXTENDED PARAMETERS		
Alkalinity	Manganese	CARCINOGENIC PAH'S	NONCARCINOGENIC PAH'S	
Ammonia Nitrogen	Magnesium	Benzo(a)anthracene	Acenaphthene	2,3-Dihydroindene
Arsenic	Mercury	Benzo(b)fluoranthene	Acenaphthylene	Fluoranthene
Cadmium	Nitrate	Benzo(k)fluoranthene	Acridine	Fluorene
Chromium	Potassium	Benzo(g)pyrene	Anthracene	Indene
Copper	Sodium	Benzo(g,h,i)perylene	Benzo(b)thiophene	Indole
Dissolved Solids	Sulfate	Chrysene	Benzo(e)pyrene	1-Methylnaphthalene
Suspended Solids	Zinc	Dibenzo(a,h)anthrancene	Benzo(h)fluoranthene	2-Methylnaphthalene
Lead	Iron	Indeno(1,2,3-cd)pyrene	Biphenyl	Naphthalene
COD*	Barium*	Quinolene	2,3-Benzofuran	Perylene
Calcium*	Chloride*		Carbazole	Phenanthrene
			Dibenzothiophene	Pyrene

*Sampled only after Spring Quarter 1992.

2.5 Sanifill C&D Waste Landfill Study

This paper presents a composition study of construction and demolition waste and analytical results from leachate collected at three Houston C&D waste landfills (Norstrom et al. 1991). The researchers' primary goal related to leachate was to identify elevated chemical constituents for tracking in a groundwater monitoring program. The researchers chose three C&D waste landfills

owned and operated by Sanifill Inc. of Houston, Texas. The landfills have liners, however the composition of the liners is unknown. The study did not indicate whether or not the landfills had leachate collection systems. The landfills accepted C&D waste composed of wood, brush, grass, concrete, rock, asphalt, metal, rubber, glass, roofing materials, carpet and drywall.

Two leachate wells were installed at each of the landfills. The leachate wells were installed by a drill rig with an 8-inch hollow stem auger. Sampling was accomplished by bailing. Samples were transported to the laboratory within two hours of sampling. Table 2.3 summarizes the salient characteristics of the landfills and leachate wells.

Table 2.3: Leachate Well Schedule

Well #	Site	Final Cover El., Ft.	Well Bottom El., Ft.	Top of Liner El., Ft.	Waste Thickness	Approx. Waste Age	Sampled/ Dry
A-L1	Landfill A	105	50	45	60	9/84	Sample
A-L2	Landfill A	110	55	52	58	12/88	Dry
B-L1	Landfill B	120	60	51	69	4/86	Sample
B-L2	Landfill B	129	50	42	67	1/89	Sample
C-L1	Landfill C	41	23	-10	51	10/87	Dry
C-L2	Landfill C	39	-1	-8	49	8/89	Dry

The study reported a range of values for each constituent. The results of this study are included in Appendix A. The study sampled for conventional parameters, heavy metals and other metals. Table 2.4 summarizes the parameters included in this study. Because the study reported a range of values, only a minimum and maximum concentration for each constituent can be determined.

One or more samples exceeded the MCL for arsenic, barium, cadmium, chromium, lead and mercury. One or more samples exceeded the SMCL for zinc, nitrate, iron, total dissolved solids, manganese, and sodium. Since leachate is often treated by an industrial wastewater treatment plant, the researchers compared the analytical results to the limits for various constituents presented in the wastewater treatment plant ordinance for the City of Houston. The levels of barium, lead, manganese, and zinc in the leachate exceeded these wastewater limits at least once. The researchers concluded that C&D leachate posed a threat to groundwater quality if not

properly contained. Also, pretreatment may be necessary if the leachate is being transported to an industrial wastewater treatment plant.

Table 2.4: Parameters Included in Sanifill C&D Waste Landfill Study

Specific Conductance	Alkalinity	Boron	Potassium
BOD 5 Days	Chloride	Phosphorous	Magnesium
Organic Nitrogen	Sodium	Cadmium	Barium
Ammonia Nitrogen	Dissolved Solids	Chromium	Selenium
Nitrate	Suspended Solids	Copper	Silver
Nitrite	Cyanide	Nickel	Mercury
COD	Calcium	Lead	Iron
Total Organic Carbon	Oil and Grease	Zinc	Manganese
Hardness	Phenol	Arsenic	Sulfates
pH			

2.6 Connecticut Bulky Waste Leachate Characterization Survey

The purpose of this study was to characterize the leachate from bulky waste landfills. The State of Connecticut used the information to assess the impacts from proposed bulky waste landfill sites (Hamel 1989). The State of Connecticut defines bulky waste as demolition debris and landclearing debris. The investigators initiated a six month study of five different landfills in 1988. Between two and four sampling events occurred during the sixth month study. Appendix A contains the results from this study.

The following five landfills were included in this report: 1) Deep River Bulky Waste Landfill, 2) Guilford Bulky Waste Landfill, 3) Glastonbury Bulky Waste Landfill, 4) Former ITI Trucking Terminal at South Windsor, and 5) Groton Bulky Waste Landfill. The study did not include a detailed description of these sites. It is unknown whether the sites have liners and leachate collection systems. The sites accept only demolition debris and landclearing debris. The samples were taken mostly from seeps at the base of the landfills. The investigators sampled for conventional parameters and heavy metals. Table 2.5 summarizes the parameters that were sampled.

There were a total of 15 samples from the five landfills. One sample exceeded the MCL for cyanide. Two samples were outside the range required for pH. Thirteen samples exceeded the

SMCL for iron. Ten samples exceeded the SMCL for total dissolved solids. All samples exceeded the SMCL for manganese. Eight samples exceeded the MCL for cadmium and thirteen samples exceeded the MCL for lead. The investigators felt that these results should be used with caution. Because the sites are relatively young and small with waste piled thinly over the site, the leachate strength could be lower than that of leachate generated at older and larger facilities. Also, the trend toward processing and recycling C&D waste could change the composition of leachate from C&D waste sites in the future. The investigators believe that reducing the decomposable portion of the waste stream should reduce the oxygen demand and nitrogen loading on surface waters. This would proportionally increase the presence of painted and processed building materials and metals from demolition waste, which could increase metal loading in the leachate.

Table 2.5: Parameters Included in State of Connecticut Leachate Study

Specific Conductance	pH	Cadmium	Barium
BOD 5 Days	Alkalinity	Chromium	Selenium
Organic Nitrogen	Chloride	Copper	Silver
Ammonia Nitrogen	Sodium	Nickel	Mercury
Nitrate	Dissolved Solids	Lead	Iron
Nitrite	Suspended Solids	Zinc	Manganese
COD	Cyanide	Arsenic	Sulfates
Hardness			

2.7 U.S. Environmental Protection Agency Summary

At the time of publication of this report, the U.S. EPA was in the process of developing a rule addressing non-municipal facilities that may receive hazardous wastes from conditionally exempt small quantity generators (CESQGs). The rule has since been promulgated as a draft by the EPA. One of the largest categories of non-municipal facilities that could accept hazardous waste from CESQGs is C&D landfills. This report was prepared in support of the EPA's rulemaking (EPA 1995).

The information used to prepare the EPA report came from literature by the National Association of Demolition Contractors (NADC) and a small number of readily available reports. The landfills included in the EPA report are identical to the landfills included in this study with

two exceptions. The EPA included the D&M site and Armetta property in Connecticut. The EPA report indicates that the data for these sites were included in the NADC leachate quality data report published in 1994. However, the copy of the NADC leachate quality data report used by this investigator did not include the D&M site or the Armetta property. The data from these sites were taken directly from the EPA report and is included in this report and are summarized in Appendix A. Because the EPA report did not include a summary of the landfill characteristics, no information is known about these two sites.

The EPA report used parameter-specific regulatory and health-based benchmarks as a basis for screening potential risks. The Safe Drinking Water Act National Primary and Secondary Drinking Water Standards were used for comparison when available. When the primary and secondary standards were not available, the EPA report used health-based benchmarks for a leachate ingestion scenario. Reference-doses were used for non-carcinogenic parameters and risk-specific doses were used for known carcinogens. No benchmark was established if sufficient studies had not been conducted on a parameter. The EPA report screened out parameters that never exceeded the benchmarks. A median concentration was calculated for each parameter that exceeded the benchmark at least once. The median value was calculated by first taking the median value of each landfill, than computing the median value for all landfills. Because of this methodology, each landfill was represented only once and each landfill was weighted exactly the same. The median value calculated in this manner was compared to the applicable benchmark.

Based on the number of landfills at which the benchmark was exceeded, and a comparison between the median and the benchmark, the EPA report felt that seven parameters were "potentially problematic." The following list shows the seven parameters of concern:

Organics	*Inorganics*	*Conventional Parameters*
1,2-dichloroethane	*cadmium*	*manganese*
methylene chloride	*lead*	*iron*
		total dissolved solids

For iron, manganese, and total dissolved solids, the benchmarks are secondary MCL's that are set to protect water supplies for aesthetic reasons (e.g., taste) rather than for health-based reasons. None of the remaining four parameters exceed the health-based benchmarks by a factor of ten or more. This fact is significant. The investigators at the EPA believed that leachate would be

diluted by a factor of ten by the time it reached any groundwater monitoring wells or drinking water wells downgradient of a C&D waste landfill. If the leachate was not at least ten times greater than the applicable groundwater standard, the groundwater resulting from the leachate would not exceed the applicable standards. Thus, the EPA did not believe that any of the seven parameters listed above would pose a problem at C&D waste landfills.

2.8 Conclusions

The data from each of these reports will be used to assess which chemical constituents found in C&D leachate could pose health and environmental problems. Appendix A contains two tables for each landfill identified in the literature sources discussed in the preceding section. The first table summarizes the landfill characteristics as reported in the literature source. The second table summarizes the analytical data gathered for the landfill. The parameters included in this table were detected at least once out of all of the data collected from the various literature sources. Eighty-two parameters were detected at least once. Table 2.6 on the following page summarizes the parameters that were analyzed for, but never detected in any sample. There were 197 parameters that were never detected in any sample.

The literature reviewed in the preceding sections indicate that parameters included in Table 2.7 have been detected at levels which could pose a threat to human health and the environment. The analysis performed in the next section will identify the chemical parameters that seem to consistently pose a threat to health and the environment.

Table 2.6 Parameters That Were Never Detected in Leachate Samples

ORGANICS	Chlorobenzene	trans-1,3-Dichloropropene	Hexachloropropene	Pentachloroethane
Acetonitrile	Chlorobenzilate	1,1-Dichloropropene	Indeno(1,2,3-cd)pyrene	Phenacetin
Acetophenone	2-Chloro-1,3-butadiene	2,3-Dichloro-1-propene	Iodomethane	Phenanthrene
2-Acetylaminofluorene	Chlorodibromomethane	cis-1,3-Dichloropropene	Isobutanol	Phenolphthalein Alkalinity
Acrolein	2-Chloroethyl Vinyl Ether	p-(Dimethylamino)azobenzene	Isodrin	p-Phenylemediamine
Acrylonitrile	4-Chloro-3-methylphenol	Dimethaote	Isophorone	Phorate
Aldrin	4-Chlorophenyl phenyl ether	7/12-Dimethylbenz(a)anthracene	2-Isophorone	2-Picoline
alpha-Chlordane	2-Chloronaphthalene	3,3-Dimethylbenzidine	Isosafrole	Pronamide
alpha-Endosulfan	2-Chlorphenol	Dimethylphenethylamine	Kepone	Propionitrile
4-Aminobiphenyl	3-Chloropropene	2,4-Dimethylphenol	Lindane	Pyrene
Aniline	Chrysene	Dimethyl phthalate	Methacryonitrile	Pyridine
Anthracene	Cumene	1,3-Dinitrobenzene	Methapyrilene	Safrole
Aramite	2,4-D	4,6-Dinitro-2-methylphenol	Methoxychlor	Silvex; 2,4,5-TP
Aroclor/PCB 1016	4,4-DDD	2,4-Dinitrophenol	3-Methychloranthrene	Sulfotepp
Aroclor/PCB 1221	4,4,4-DDT	2,4-Dinitrotoluene	Methyl methacrylate	TCDD
Aroclor/PCB 1232	delta-BHC	2,6-Dinitrotoluene	(3&4)-Methylphenol	2,3,7,8-TCDD
Aroclor/PCB 1242	Diallate	Dinoseb, DNBP	1,4-Naphthpquinone	TCDF
Aroclor/PCB 1248	Dibenzo(a,h)anthracene	Di-a-octyl phthalate	1-Naphthylamine	1,2,4,5-Tetrachlorobenzene
Aroclor/PCB 1254	Dibenzofuran	Di-n-octyl phthalate	2-Naphthylamine	1,1,1,2-Tetrachlorethane
Aroclor/PCB 1260	Dibromochloromethane	1,4-Dimene	3-Nitroaniline	1,1,2,2-Tetrachlorethane
Benzo-a-anthracene	1,2-Dibromo-d-chloropropane	Diphenylamine	4-Nitroaniline	2,3,4,6-Tetrachlorophenol
Benzo-a-pyrene	Dibromomethane	Endosulfan sulfate	Nitrobenzene	Tetrahydrofuran
Benzo-b-fluoranthene	1,2-Dibromoethane	Endosulfan I	o-Nitrophenol	Thionazin
Benzo(k)fluoranthene	Di-a-butyl phthalate	Endosulfan II	p-Nitrophenol	o-Toluidine
Benzo-g,h-perylene	Dichloroacetonitrile	Endrin aldehyde	4-Nitroquininoline-1-oxide	Toxaphene
Benzyl alcohol	1,2-Dichlorobenzene	Endrin ketone	N-Nitrosodi-a-butylamine	1,2,4-Trichlorobenzene
beta-BHC	1,3-Dichlorobenzene	Ethyl ether	N-Nitrosodiethylamine	1,1,1-Trichloroethane
beta-Endosulfan	1,4-Dichlorobenzene	Ethylmethacrylate	N-Nitrosodimethylamine	1,1,2-Trichloroethane
Bis(2-cholorethoxy)methane	3-3-Dichlorobenzidine	Ethyl methane sulfonate	N-Nitrosodimethylethylamine	2,4,5-Trichlorophenol
Bis(2-chloroethyl)ether	trans-1,4-Dichloro-2-butene	Ethyl parathion	N-Nitrosodiphenylamine	2,4,6-Trichlorophenol
Bis(2-chloro-1-methyl)ether	Dichlorodifluoromethane	Famphur	N-Nitrodo-di-n-propylamine	1,2,3-Trichloropropane
Bromodichloromethane	1,2-Dichloroethene	Fluoranthene	N-Nitrosomorpholine	1,1,2-Trichlorotrifluorethane
Bromoform	1,1-Dichlooethene	Fluorene	N-Nitrosopiperidine	o,o,o-Triethyl phosphorothiole
Bromomethane	Dichlorofluoromethane	Heptachlor	N-Nitrosopyrolidine	sym-Trinitrobenzene
4-Bromophenyl-phenylether	2,4-Dichlorphenol	Heptachlor epoxide	5-Nitro-o-toluidine	Vinyl acetate
Butyl benzyl phthalate	2,6-Dichlorphenol	Hexachlorobenzene	PeCDD	Vinyl chloride
Carbon tetrachloride	trans-1,3-Dichloropropane	Hexachlorobutadiene	PeCDF	
Carbonate	1,2-Dichloropropane	Hexachlorocyclopentadiene	Pentachlorobenzene	**INORGANICS**
Chlorodane	1,3-Dichloropropane	Hexachloroethane	Pentachloronitrobenzene	Thallium
4-Chloroaniline	2,2-Dichloropropane	Hexachlorophene	Pentachlorophenol	Tin

Table 2.7: Parameters Identified as Problematic in the Literature

ORGANICS	HEAVY METALS		CONVENTIONAL PARAMETERS	
1,2-Dichloroethane	Arsenic	Lead	Boron	Nitrite
Methylene Chloride	Barium	Mercury	Chloride	pH
	Cadmium	Zinc	Cyanide	Sodium
	Chromium		Iron	Sulfate
			Manganese	Total Dissolved Solids
			Nitrate	

3.0 Methodology for Statistical Analysis

3.1 Introduction

The literature sources that have been reviewed employed a variety of methods to analyze leachate data. The most frequent method used by the investigators was a simple comparison between the leachate data and a regulatory limit (primary maximum contaminant levels (MCL's), secondary MCL's, or other guidance concentrations). The authors of the Waste Management report compared the leachate data gathered in 1993 to data gathered in 1991 and 1992. The authors looked for trends to determine if the leachate would be classified as a hazardous waste, and compared the data to the applicable groundwater standards. The EPA report of 1995 was the only study that attempted to statistically analyze leachate data. Investigators at the EPA determined a median value for each parameter at each landfill. These median values were then analyzed and compared to the applicable groundwater standard. The investigators at the EPA chose to use the median value of the combined data as the statistic to compare with the groundwater standards. The EPA did not use the non-detects in their calculations of the median values. They treated the non-detects as if they were never reported. If a sample was analyzed for a parameter, but the laboratory was not able to detect the parameter, the value given to the parameter is known as a non-detect. The laboratory reports the results as "<x", where x is the method detection limit.

The EPA conducted only a cursory statistical analysis on the leachate data (EPA 1995). The leachate data gathered for this report will be analyzed using statistical procedures described in "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities" (EPA 1989, 1992). This publication is intended to assist in the evaluation of groundwater monitoring data. Although the data under study are from leachate, not groundwater wells, the statistical procedures given in the publication will handle all types of water samples. The advantage to using these statistical procedures is that they can handle non-detected data. Thus, the results of these statistical tests will be more appropriate because the non-detects were included in the study.

3.2 Methodology

The methods used to analyze the data are similar to the methods used in the other reports and studies reviewed in chapter two. The basic approach included several steps. The first step was to determine the mean of all the parameters for each landfill. All of data were then combined

and values determined for the mean and maximum concentrations for each parameter over all of the landfills. Other statistics such as the number of times the parameter was detected at different landfills were also determined. The results of these steps are included in tabular form, and for certain parameters, graphical form. The last step involved conducting a statistical test of the data to determine if parameters could pose a risk to human health and the environment. This was accomplished by comparing leachate data for a particular contaminant to a regulatory standard for groundwater. It is recognized that leachate from a landfill is more concentrated than leachate-contaminated groundwater, but this method provides an assessment of the level of concern which should be awarded a particular contaminant. The following sections will address in detail the methods used to analyze the data.

The number of samples that were reported for each landfill varied from 1 to 20. The raw data could not be analyzed by treating all of the data as one large data set because the landfills with more samples would disproportionately influence the results. In order to avoid this situation, all of the samples at a particular landfill were averaged. The averages were then used to represent each landfill. This procedure ensured that each landfill was equally represented. The averaged data at each landfill were used to conduct the statistical analysis.

The mean was chosen instead of the median because the mean gives a larger numeric value. In order to determine if a parameter is statistically the same as or greater than the applicable regulatory standard, a value representing the parameter is compared to the standard. The larger the value is, the higher the probability is that the parameter will exceed the standard. This investigator wants to report the worst possible scenario, therefore each parameter will be represented by the largest possible value. For the data being analyzed, there tends to be large outlying values. These data points will increase the value of the mean. The median is not influenced by outlying values, therefore the median value would tend to be lower than the mean.

The data are separated into five categories: 1) volatile organics, 2) semi-volatile organics, 3) other organics, 4) heavy metals, and 5) conventional parameters. Most landfills analyzed for conventional parameters and heavy metals. Less than 10 landfills analyzed their samples for volatiles, semi-volatiles, and other organics such as pesticides and herbicides. To compound the problem, few landfills actually detected these three groups of chemicals in the leachate. It is difficult to conduct a full statistical analysis on these three groups because of the infrequency of

sampling and the large percentage of non-detects. For these three categories, the data were analyzed using a simple statistical procedure. For each parameter, the mean was calculated from the average values for the landfills. Along with the mean, the maximum concentration and the maximum mean value for a landfill was reported for each parameter. The data in these three groups were not analyzed further.

The two remaining groups of data are heavy metals and conventional parameters. There were sufficient data in both these groups to perform a complete statistical analysis. There are four methods to handle the data depending on the number of sites that sampled for a parameter, the number of non-detects for a parameter, and the distribution of the data. The methods include Cohen's Method, Aitchinson's Method, the standard student t-test, and a nonparametric test. All methods were taken from "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities" (EPA 1989). The test procedures are briefly summarized in the following sections.

For each landfill, the mean of each parameter was computed. This mean became the reported value of the parameter for each landfill. The non-detects were converted to one-half the method detection limit. If the method detection limit was not given for a sampling round, the method detection limit given by "Test Methods for Evaluating Solid Waste Physical/Chemical Methods" (EPA 1986) or "Methods for Chemical Analysis of Water and Wastes" (EPA 1979), was used in its place. In some cases, the actual test method was also unknown. For these instances, the sampling data from another landfill that analyzed for the same parameter were reviewed. The test method used for the parameter in the majority of the sampling data was substituted for the unknown test method. Appendix B contains a summary of the test methods and method detection limits used in the analysis. The mean values at each landfill were analyzed by all of the following statistical methods.

3.3 Standard Student T-Test

When comparing sampling data to a constant compliance limit, the appropriate statistical method is to determine a confidence interval, tolerance interval, or prediction interval, and compare the compliance limit to the interval. Intervals normally take the following form:

$$\mu \pm z * \sigma/_{n}, \text{ where } \mu = \textit{average},\ \sigma = \textit{standard deviation},\ n = \textit{sample size},\ z = \textit{varies}$$

The variable z varies depending on the method used and the characteristics of the data set. The intervals will vary in width depending on the z that is used. The main difference between the three intervals is the z that is used to construct the intervals. Confidence intervals are used when comparing compliance limits that are not health based. They can be less stringent, therefore the z is usually around 2.0 for a 95% confidence interval. Confidence intervals are widely used in statistical analysis (Ott 1992). The tolerance intervals and prediction intervals are specified for groundwater monitoring situations where the compliance officer wants to ensure that the limit is exceeded only a small fraction of the time. Because of this, these intervals are very stringent. The z's used for the tolerance intervals are much higher than two, therefore the intervals are much wider than the confidence intervals. The tolerance and prediction intervals would not be appropriate for analyzing leachate data. As previously discussed, leachate is highly concentrated and is not representative of the groundwater in the area of the landfill. Applying stringent requirements to leachate would result in most of the parameters being identified as problems. Confidence intervals are less stringent than tolerance or prediction intervals, yet they will still identify when the mean of the leachate is approximately equal to or larger than the appropriate groundwater limit.

The confidence intervals are constructed so that there is a 99% chance that the actual mean for the data is contained in the interval. The mean and standard deviation for each parameter are calculated. The confidence interval is constructed by the following equation:

$$\bar{x} \pm t_{(0.99,n-1)} \, {}^{S}\!/_{\sqrt{n}}, \text{ where } \bar{x} = \text{mean}, \ S = \text{standard deviation, and } n = \text{sample size}$$

The EPA publication recommends the following approach (EPA 1989, 1992). The approach is illustrated in Figures 3.1 and 3.2. Figure 3.1 shows a MCL of 100 units which is contained within the confidence interval that extends from 5 to 150 units. Figure 3.2 shows a MCL of 0.5 units which is below the same confidence interval. The EPA manual would say that the situation represented in Figure 3.1 is in compliance because not all of the data are above the MCL of 100 units (EPA 1989, 1992). Figure 3.2 is out of compliance because all of the data are above the MCL of 0.5 units. In summary, 99% of the data must be above the MCL before the EPA approach would consider the parameter out of compliance. This investigator feels the EPA approach is not appropriate for this study. Since the confidence interval is constructed to contain

Figure 3.1: Example 1 of Confidence Intervals

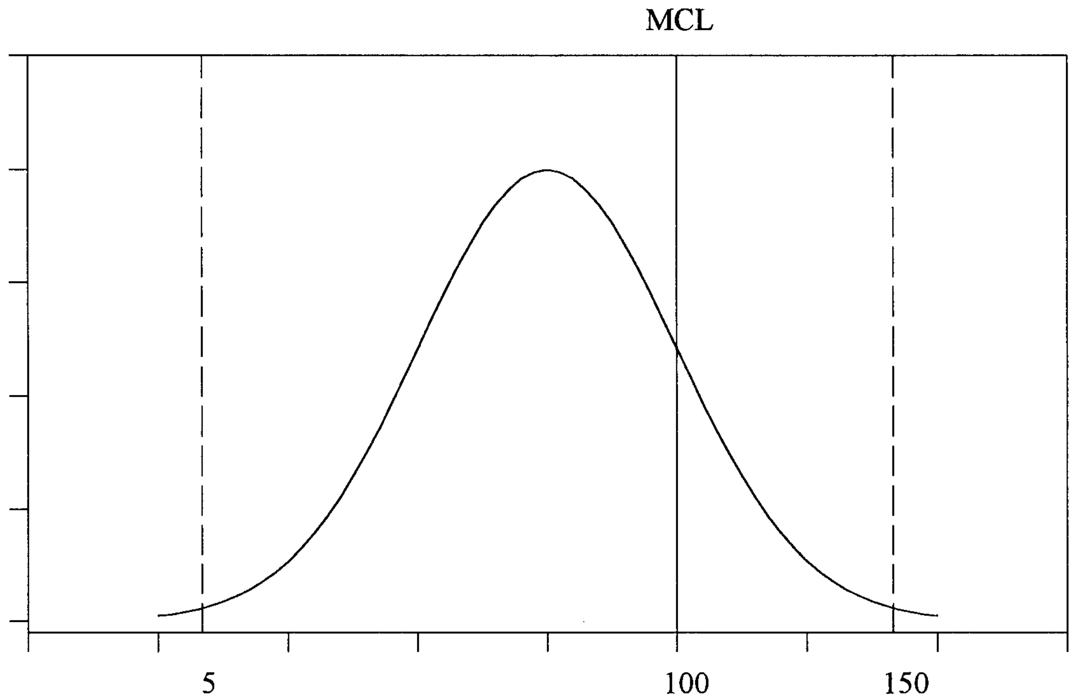
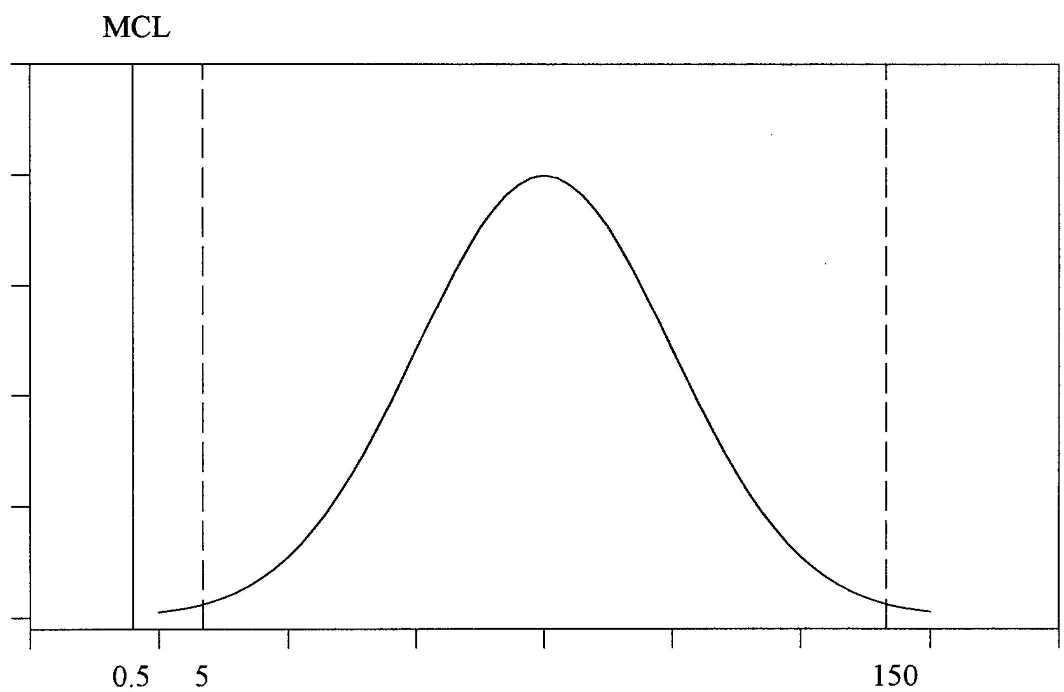


Figure 3.2: Example 2 of Confidence Intervals



99% of the values that could be the actual population mean, if the MCL is within the interval, there is a possibility that the MCL is the population mean. Using this rationale, Figure 3.1 would be out of compliance because there is a possibility that the mean of the data equals 100 units. This investigator feels that if a MCL is within the confidence interval, it should be declared a problem. The only way a set of data would be in compliance is if the MCL was higher than the entire confidence interval. Any other result will be deemed out of compliance and therefore could present a risk to the public health and environment. This investigator feels this combination approach is sufficiently conservative to identify problems, without being so conservative that everything is a problem.

The student t-test can only be used when the sample contains less than 15% non-detects (EPA 1989). The non-detects are set at one-half of the method detection limit, and the mean and standard deviation are calculated including the non-detects. As stated previously, some of the samples did not include method detection limits. In those cases, the appropriate method detection level was determined based on "Test Methods for Evaluating Solid Waste Physical/Chemical Methods" (EPA 1986), or "Methods for Chemical Analysis of Water and Wastes" (EPA 1979). Appendix B contains a summary of the test methods and the method detection limits used in this report. If more than 15% of the sample contained not detects, one of the following methods was used to determine the confidence intervals.

3.4 Cohen's Method

Cohen's method provides estimates of the sample mean and standard deviation when the percent of not-detects is between 15% and 50% (EPA 1989, 1992). The underlying assumption of this method is that all of the data (detects and non-detects) come from the same normal or log-normal population, but that the non-detects have been censored at the detection limit. This means that the parameter is present in the sample, but cannot be "seen." In order to test this assumption, a probability plot of the data should be constructed. To construct a probability plot, all of the data are ranked from smallest to largest, including the non-detects. The cumulative probability and normal quantiles are constructed from the ranked data. The cumulative probability is equal to the $i/(n+1)$ where i is the rank and n is the sample size. The normal quantiles are simple the z statistic that corresponds to the cumulative probability. The actual concentrations are plotted against the normal quantiles. If the sample is normally distributed, the data should plot as a

straight line (approximately). The non-detects are not plotted. Some samples follow a log-normal distribution, or the log of the concentration plotted against the normal quantile is a line. In order to determine whether this method was appropriate, the parameters with percentages of non-detects between 15% and 50% where analyzed in this manner. Probability plots of the data and the log of the data were constructed to determine if it was appropriate to use this method. These plots are included in Appendix C.

Once it was determined that this method was appropriate for a parameter, the following equations were used to calculate a cohen parameter, lambda:

$$h = {(n-m)}\Big/{n}, \quad \gamma = {S_d^2}\Big/{(\overline{x}_d - DL)^2}, \text{ where } S_d^2 = \text{variance of detected values,}$$

$$\overline{x}_d = \text{mean of detected values, } n = \text{total sample size, } m = \text{total number of detected values}$$

The first equation calculates the fraction of non-detects, or *h*. The second equation calculates a parameter γ, which is used to determine lambda. DL is the method detection limit for the parameter. Once is γ determined, the following equation is used to determine the adjusted mean and sample standard deviation:

$$\overline{x} = \overline{x}_d - \hat{\lambda}(\overline{x}_d - DL) \text{ and } S = (S_d^2 + \hat{\lambda}(\overline{x}_d - DL)^2)^{\frac{1}{2}}, \text{ where } \overline{x} = \text{adjusted mean,}$$

$$\tilde{\lambda} = \text{Cohen's parameter based on } \lambda \text{ and } h, \text{ and } S = \text{adjusted standard deviation}$$

All other variables in the above equation have the same meaning as previously described. These adjusted mean and standard deviations are used in the above student t-test to determine the confidence intervals.

3.5 Atichinson Method

The Atichinson Method may also used when a sample contains between 15% and 50% of non-detects (EPA 1989, 1992). The difference between the two methods lies in the assumptions. This method assumes that the detected values come from a normal or log-normal distribution, but that the non-detects are equal to zero. In order to test the assumption, a probability plot is constructed from the data, but the non-detects are not included in the ranking. If the plot of concentration versus normal quantile is linear, than the assumption is valid. This method was used for only one parameter, and the probability plot for the parameter is included in Appendix B.

The adjusted mean and standard deviation are computed based on the following equations:

$$\hat{\mu} = (1 - \frac{d}{n})\bar{x}^* \text{ and } \hat{\sigma}^2 = \frac{n-(d+1)}{n-1}(s^*)^2 + \frac{d(n-d)}{n(n-1)}(\bar{x}^*)^2, \text{ where } s^* = \text{std dev of detected values,}$$

$$\bar{x}^* = \text{mean of detected values, } n = \text{total sample size, and } d = \text{ no. of non-detects.}$$

The adjusted mean and standard deviation are used in a standard student t-test to compute the confidence interval for the parameter.

3.6 Nonparametric Method

A nonparametric approach is necessary if there are more than 50% but less than 90% non-detects (EPA 1989). The nonparametric approach is used because when there are so many non-detected values, the data do not follow a normal distribution. This method requires a minimum of 7 data points. The confidence interval constructed with this method gives a two-sided, 98% confidence interval, corresponding to a one-sided confidence coefficient of 99%. The data are ordered from least to greatest with the lowest rank assigned a value of 1. The critical values of the ordered data are determined by the M value that is calculated as follows:

$$M = n/2 + 1 + z_{0.99}\sqrt{(n/4}, \text{ where } n = \text{sample size}$$

The z statistic is approximately equal to 2.33. Once M is calculated, the quantity (n+1-M) is calculated. The confidence interval is equal to the data points of rank (n+1-M) and M. If the compliance limit is within the interval or is smaller than the interval, than the parameter is a potential problem.

4.0 Analysis

4.1 Introduction

Each of the five groups of chemicals will be analyzed separately. A statistical test was not conducted on the volatile organics, semi-volatile organics and other organic compounds. The analysis will be limited to a direct comparison of other the minimum, maximum, and mean of the samples to the applicable groundwater standard. Statistical tests were conducted on the heavy metals and conventional parameters, therefore the results of these tests will be analyzed along with box plots for certain key parameters. The analysis will also attempt to identify possible contaminant sources for the parameters.

In the following analysis, parameters will be deemed to be "problems" when the mean concentration of the parameter in the <u>leachate</u> exceeds the applicable groundwater standard. The parameter is a "problem" in leachate because it could be present in <u>groundwater</u> at concentrations that exceed the applicable standards. If the parameter was present at concentrations that exceed the standards, the landfill would be out of compliance. Stronger terminology cannot be used because there is no information on groundwater quality at these landfills. Leachate at these landfills will become diluted with groundwater before it reaches any groundwater monitoring wells. The amount of dilution will vary, therefore no inferences can be made between concentrations in leachate and concentrations in groundwater. The only conclusion that can be made is that if the concentration of a parameter in <u>leachate</u> does not exceed the applicable groundwater standards, the parameter should not be present in <u>groundwater</u> at levels that exceed the standard. Any other scenario could present a problem for the landfill.

4.2 Volatile Organic Compounds

Seventeen volatile organic compounds were detected in the leachate samples. Table 4.1 on the following page summarizes the findings for these parameters. The following nine chemicals never exceeded either the primary maximum contaminant level (MCL), secondary maximum contaminant level (SMCL), or the guidance concentration recommended by the State of Florida (Florida Department of Environmental Protection 1994):

2-Butanone	*Carbon Disulfide*	*1,1-Dichloroethane*	*Xylenes*
Methyl Ethyl Ketone	*Ethyl Benzene*	*1,1,1-Trichloroethane*	*Toluene*
Trichlorofluoromethane			

Table 4.1: Summary Statistics for Volatile Organics.

Parameter	Sites that Sampled Parameter	Sites that Detected Parameter	Percent Detected	Max. Conc. Overall[1]	Max. of Means[2]	Mean[3]	Primary MCL	Secondary MCL	Guidance Conc.	No. Of Means Over Limits[4]
Acetone	7	4	57%	100	2570.5	818			700	1
Benzene	9	3	33%	2.7	2.7	1.5			1	1
2-Butanone	6	2	50%	2500	2500	1277			4200	0
Carbon Disulfide	6	3	50%	15	15	10.9			700	0
Chloromethane	9	2	22%	43	43	33.5			3	2
1,1-Dichloroethane	9	5	56%	48	48	13.94			700	0
1,2-Dichloroethane	9	3	33%	26	26	18.07	3			3
1,4-Dioxane	5	1	20%	49	49	49			5	1
Ethyl Benzene	9	5	56%	18	9.5	3.41		700		0
Methyl Ethyl Ketone	6	2	33%	2500	1445	957.5			4200	0
4-Methyl-2-Pentanone	8	2	25%	250	250	129.45				NA
Methylene Chloride	9	4	44%	60	60	26.4	5			4
Toluene	9	7	78%	290	265	60.91	1000			0
1,1,1-Trichloroethane	6	1	17%	1	1	1	200			0
Trichloroethylene	9	4	44%	20	20	7.34	3			3
Trichlorofluormethane	6	2	33%	20	20	16.5			2100	0
Xylenes	9	6	67%	120	69.7	20.25	10000			0

Notes:

1) This is the maximum concentration that was every detected of all samples.
2) This is the maximum average concentration of the landfills.
3) Mean does not include non-detects.
4) This is the number of times that the average landfill concentrations exceeded the applicable groundwater standards.

These contaminants should not pose a threat to human health or the environment because they never exceeded the applicable groundwater standards, therefore they will not be considered further. Seven contaminants exceeded the groundwater standards at least once and have means that also exceeded the groundwater standards:

Acetone	*Benzene*	*Chloromethane*	*1,2-Dichloroethane*
1,4-Dioxane	*Methylene Chloride*	*Trichloroethylene*	

The problem with declaring all of these contaminants a potential health problem is that some of these contaminants were only detected at two or three sites. Also, the mean reported in Table 4.1 is a conservative estimate of the actual mean because the non-detects were excluded. The data cannot be analyzed with any degree of confidence because the sample sizes are small and the number of detected values is also small. Of these compounds, only acetone was detected over fifty percent of the time. The mean concentration for acetone was 818 ug/l, which is only slightly higher than the guidance concentration of 700 ug/l. Because the mean is only slightly higher than the groundwater limit, and there were three non-detected values out of seven total sites, it is difficult to say that acetone will be a problem at C&D landfills. C&D landfills should conduct preliminary groundwater tests for acetone to determine if their particular site has a problem with this constituent.

Although methylene chloride and 1,2-dichloroethane were only detected 33% and 44% of the time respectively, the mean concentrations for these contaminants greatly exceed the primary MCL's. The mean concentration of methylene chloride is 26.4 ug/l, which is approximately five times higher than the MCL of 5 ug/l. Likewise, the mean concentration of 1,2-dichloroethane is 18.07 ug/l, which is approximately six times higher than the MCL of 3 ug/l. These contaminants could be present in groundwater at levels that exceed the groundwater standards. Therefore, they could pose a potential risk to health and the environment simply because when they are detected, they are detected at levels that greatly exceed their groundwater standards. Although more research is needed to estimate a true mean concentration for these contaminants, they should be regarded as problems and should C&D landfills should test for these constituents.

The literature indicates several sources of contamination from volatile organic compounds. Petroleum constituents such as benzene can leach from roofing tar and asphalt (EPA 1995). Containers of excess solvents and oils that include many volatile compounds such as

1,2-Dichloroethane are routinely disposed of at C&D landfills. Acetone is a commonly used solvent and cleaner and is found in PVC glue. Acetone could find its way into C&D waste landfills in semi-empty containers.

There are some apparent trends in the data for volatile organic. Of the ten landfills that sampled for these parameters, one landfill accounted for the majority of the highest concentrations. The Massachusetts site detected thirteen compounds and all thirteen were the highest concentrations for the compounds. The Michigan site detected nine compounds, but had none of the highest concentrations. The other landfills had a smaller number of detected compounds and a lower number of the highest concentrations.

In conclusion, more data should be gathered on the presence of volatile organic compounds in leachate. The two contaminants that seem to pose a threat to human health and the environment are methylene chloride and 1,2-dichloroethane because when they are present, they greatly exceed the applicable groundwater standards. Acetone should be included in preliminary testing at C&D landfills because it is present frequently and at concentrations that are roughly equivalent to the groundwater standards.

4.3 Semi-Volatile Organic Compounds

Fourteen semi-volatile organic compounds were detected in the leachate samples. Table 4.2 on the following page summarizes the findings for these parameters. The following eight chemicals never exceeded the guidance concentration recommended by the State of Florida (Florida Department of Environmental Protection 1994):

Acenaphthene	*Acetophenone*	*2,4-Dimethylphenol*	*Di-n-Butyl Phthalate*
Diethyl Phthalate	*Fluoranthene*	*o-Creosol*	*Pyrene*

Because the maximum concentrations for these chemicals do not exceed the recommended guidance concentrations, these chemicals should not pose a threat to health and the environment.

The following five chemicals exceeds the recommended guidance concentration at least once:

Benzoic Acid	*Napthalene*	*m&p-Creosol*	*Phenathrene*	*Phenol*

Of these chemicals, the mean concentration for napthalene, m&p-creosol, phenathrene, and phenol exceeded the recommended guidance concentrations. The mean concentrations were calculated without the non-detects, therefore, these means are a conservative estimate of the true

Table 4.2: Summary of Statistics for Semi-Volatile Organics.

Parameter	Sites that Sampled Parameter	Sites that Detected Parameter	Percent Detected	Max. Conc. Overall[1]	Max. of Means[2]	Mean[3]	Primary MCL	Secondary MCL	Guidance Conc.	No. Of Means Over Limits[4]
Acenaphthene	5	1	20%	4	3.5	3.5			20	0
Acetophenone	4	1	20%	2	0	0			700	0
Benzoic Acid	9	4	44%	53000	53000	15457			28000	1
Bis-(2-Ethylhexyl)phthalate	8	2	25%	31	31	16.5				NA
2,4-Dimethylphenol	8	1	13%	15	15	15			400	0
Di-n-Butyl phthalate	8	2	25%	11	11	9			700	0
Diethyl Phthalate	8	3	38%	16	16	8			5600	0
Fluoranthene	8	1	13%	180	180	180			280	0
Napthalene	8	3	38%	130	130	86			7	3
m&p-Creosol	8	3	38%	5700	4450	1822			35	3
o-Creosol	8	2	25%	64	64	50			350	0
Phenathrene	8	2	25%	300	300	151.5			10	1
Phenol	6	3	50%	1900	1055	383.5			10	3
Pyrene	8	1	13%	190	190	190			210	0

Notes:
1) This is the maximum concentration that was every detected of all samples.
2) This is the maximum average concentration of the landfills.
3) Mean does not include non-detects.
4) This is the number of times that the average landfill concentrations exceeded the applicable groundwater standards.

population means. Moreover, these chemicals were detected less than 40% of the time when they were sampled. Because of the conflicting data, it can not be determined whether these contaminants will pose a problem at all C&D landfills. However, leachate from C&D landfills should initially be analyzed for these constituents to ensure that these constituents are not present in harmful concentrations. If a leachate collection system is not installed, leachate wells should be installed so the leachate can be tested. If preliminary testing indicates that the leachate is free of these constituents, than the testing could be discontinued as long as the composition of the waste stream remains the same.

Some possible sources of the contamination include wood products, adhesives, and resins (EPA 1995). Napthalene and m&p-Cresol are used to preserve wood products, particularly wood products that will be exposed to the weather like railroad ties, utility poles, and pilings. Phenol-formaldehyde resins are used as either adhesives or resins on wood products. Phenol is also used as a laminate. Phenols, xylene, napthalene, fluorene, phenanthrene, anthracene, and pyrene have been shown to leach from roofing felt and building insulation (Goumans 1991). Most of these products are applied to wood products. It would be impractical to ban wood products from C&D landfills. However, if a landfill is having a problem with constituents that are leaching from preserved wood, banning preserved wood should help to alleviate the problem.

There are some apparent trends in the data for semi-volatile organic. Of the nine landfills that sampled for these parameters, two landfills account for the majority of the highest concentrations. The Massachusetts site detected seven compounds and had four of the highest concentrations. The Kentucky Site detected four compounds and all four of these were the highest concentrations for the compounds. The Michigan site detected seven compounds also, but had none of the highest concentrations. The other landfills had a smaller number of detected compounds and a lower number of the highest concentrations.

In conclusion, more study is needed to determine if semi-volatile organic compounds contained in C&D leachate will pose a threat to human health and the environment.

4.4 Other Organic Compounds

This group includes herbicides, pesticides and dioxans/furans. There were nine organic compounds that fall in this group that were detected at least once. . Table 4.3 summarizes the

Table 4.3: Summary of Statistics for Other Organics.

Parameter	Sites that Sampled Parameter	Sites that Detected Parameter	Percent Detected	Max. Conc. Overall[1]	Max. of Means[2]	Mean[3]	Primary MCL	Secondary MCL	Guidance Conc.	No. Of Means Over Limits[4]
Alpha-BHC	7	1	14%	0.12	0.12	0.12			0.05	1
Endrin	7	2	29%	0.05	0.05	0.06	2.0			0
Dieldrin	7	2	29%	0.2	0.2	0.13			0.10	1
Dimethoate	4	1	25%	2.7	2.7	2.7			5	0
Disulfoton	4	2	50%	5.6	5.6	3.28			0.5	2
2,4,5-T	4	1	25%	0.53	0.53	0.53			70	0
2,4-D	4	2	50%	29	29	15.6	70			0
HxCDD	4	1	25%	5.5	5.5	5.5				NA
HxCDF	4	1	25%	7.7	7.7	7.7				NA

Notes:
1) This is the maximum concentration that was every detected of all samples.
2) This is the maximum average concentration of the landfills.
3) Mean does not include non-detects.
4) This is the number of times that the average landfill concentrations exceeded the applicable groundwater standards.

findings for these parameters. Of these seven compounds, the following three had means that exceeded the applicable groundwater standards:

Alpha-BHC *Dieldrin* *Disulfoton*

However, no conclusions can be reached regarding these compounds. Alpha-BHC had a mean concentration of .12 ug/l, which is approximately twice the guidance concentration of 0.05 ug/l. However, alpha-BHC was only detected once out of seven landfills. This low percentage of detection greatly reduces the significance of the mean concentration. Dieldrin had a mean of 0.13 ug/l, which is approximately equal to the guidance concentration of 0.10 ug/l. Dieldrin was detected at two of seven sites. Again, the low percentage of detected values greatly reduces the significance of the mean concentration. Finally, disulfoton had a mean of 3.28 ug/l, which is roughly six times the guidance concentration of 0.5 ug/l. Disulfoton also was detected at fifty percent of the sites that sampled for it. However, only four sites sampled for disulfoton. There is simply not enough data to conclude anything about disulfoton. Because of the low number of samples and the low number of detected values, no conclusions can be reached concerning this group of chemicals.

Although the literature does not identify potential sources for herbicides and pesticides, the source of these chemicals could be vegetation that is accepted at C&D landfills.

There are some trends in the data. Of the seven landfills that tested for these compounds, two landfills account for seven of the nine highest concentrations. The Massachusetts site detected five compounds and had four of the highest concentrations. The Michigan site detected four compounds and had three of the highest concentrations. The other landfills had smaller numbers of detected compounds and the highest concentrations.

In conclusion, more study is needed to determine if herbicides, pesticides and dioxans/furans contained in C&D leachate will pose a threat to human health and the environment.

4.5 Heavy Metals

With a few exceptions, heavy metals were sampled frequently, therefore, a statistical analysis was conducted on this group of parameters. The leachate samples were analyzed for fourteen heavy metals. Only thallium was never detected in any sample. Table 4.4 on the following page summarizes the findings for these parameters, including the results of the statistical analysis.

Table 4.4: Summary of Statistics for Heavy Metals.

Parameter	Sites that Sampled Parameter	Sites that Detected Parameter	Percent Detected	Max. Conc. Overall.[1]	Max. Of Means[2].	Mean[3]	Primary MCL	Secondary MCL	Guidance Conc.	Confidence Interval	Poses Problem?[4]
Antimony	6	1	17%	5.8	6.9	36.23	6			NA	NA
Arsenic	16	12	75%	77.3	46	12.27	50			(0, 24.6)	No
Barium	13	13	100%	8000	4750	661.4	2000			(0, 1592.5)	No
Cadmium	19	11	58%	2050	512.88	31.9	5			(0,100.3)	Yes
Chromium	18	8	44%	250	175	NA	100			(0, 20.8)	No
Copper	18	14	78%	620	315	20.3	1000			(6.9, 59.8)	No
Lead	18	12	67%	2130	1175	8.82	15			(1.2, 66.2)	Yes
Mercury	15	4	27%	9	5	NA	2			(0, 0.5)	No
Nickel	13	7	54%	170	120	20.00	100			(8.1, 49.5)	No
Selenium	14	1	7%	5	3.41	2.78	50			NA	No
Silver	11	2	18%	30	17.5	NA		100		(0, 10.4)	No
Thallium	7	0	0%	0	0	0	2			(0, 0)	No
Vanadium	5	2	40%	96	42	22.8			49	NA	No
Zinc	15	15	100%	8630	5165	657.70		5000		(0, 1501.4)	No

Notes:

1) This is the maximum concentration that was every detected of all samples.

2) This is the maximum average concentration of the landfills.

3) The mean includes non-detects. If a statistical analysis was conducted, the mean is the reported mean is the mean calculated from the stat. tests.

4) A parameter poses a problem if the applicable groundwater standard is contained within the confidence interval.

A statistical analysis could not be conducted on the data for antimony, selenium, and vanadium. There was not enough data gathered on antimony and vanadium to conduct a statistical test. Although selenium was analyzed frequently, 93% percent of the data was non-detects. Statistical tests fail when a data set has more than 90% non-detects. Vanadium and selenium should not pose a problem because the mean of the data, including non-detects, fall below the applicable groundwater. The mean for each landfill was calculated as the mean of all data with the non-detects assuming one-half the value of the method detection limit. If the method detection limit for a sample was not known, the method detection limit was provided by either EPA publication SW-846, "Test Methods for Evaluating Solid Waste Physical/Chemical Methods," or EPA publication EPA-600, "Methods for Chemical Analysis of Water and Wastes." The overall mean was determined in the same manner with non-detects assuming one-half the value of the method detection limit.

For antimony, the overall mean calculated in this manner was higher than the maximum concentration every detected. This happened because the method detection limits for some landfills were much higher than the maximum concentration every detected. For antimony, only one site out of seven ever detected the metal and the detected value was less than the groundwater standard. The mean of 36.23 ug/l is very suspect because the non-detects actually increased the mean, instead of decreasing the mean as would normally happen. No conclusions can be drawn from the data that was reported. Further study is needed to conclusively determine if antimony poses a threat to human health and the environment. The only conclusion that can be drawn is that the method used to test for antimony should have a method detection limit less than the groundwater standard of 6 ug/l. From EPA publication SW-846, Method 7041, antimony has a method detection limit of 3 ug/l.

The results of the statistical tests indicate that the following heavy metals could endanger human health and the environment:

Cadmium *Lead*

The statistical tests are included in Appendix D. For copper, lead, and nickel, the data had to be transformed into the log of the concentration. The statistical analysis was performed on the transformed data, then the results were converted back to the original scale. The confidence intervals were constructed after the data was converted back the original scale. The adjusted

mean calculated by Aitchinson's Method for cadmium is 31.94 ug/l. The confidence interval is (0, 100.3) ug/l. The groundwater standard for cadmium is 5 ug/l. The confidence interval encompasses the mean, therefore it is statistical possible that actual mean for cadmium at C&D landfills is at least 5 ug/l. The mean is six times higher than the groundwater standard. The adjusted mean calculated by Cohen's Method for lead is 8.82 ug/l. The confidence interval is (1.2, 66.2) ug/l. The confidence interval encompasses the mean, therefore it is statistical possible that actual mean for lead at C&D landfills is at least 15 ug/l. In this case the actual adjusted mean is less than the groundwater standard. However, the confidence interval indicates that the actual mean could be as high as 66.2, therefore lead does pose a risk to human health and the environment.

The statistical tests for the remaining nine heavy metals indicate that there is less than a 2% chance that the actual mean is equal to or higher than the applicable groundwater standard. Therefore, these metals will be classified as not problematic and no further analysis is needed.

4.5.1 Box Plots for Heavy Metals

Box plots for several common heavy metals have been developed to show the distribution of the data. Figure 4.1 shows a typical box plot. The box shows the various percentiles for the data. A percentile is a measure of variability. The xth percentile of a set of measurements arranged in order of magnitude is that value that has x% of the measurements below it (Ott 1993). Therefore the 25th percentile is the value that has 25% of the data below it. The ends of the box indicate the 25th and 75th percentile. The hash marks that extend on a line from the boxes indicate the 10th and 90th percentiles. Any circles indicate values beyond the 10th and 90th percentiles. The solid line inside the box shows the median for the data, or the 50th percentile. The dashed line either inside or outside the box shows the mean of the data, or the average. The solid line that extends from the top of the figure to the x-axis shows the applicable groundwater standard for the parameter. Not all box plots will include this line.

Figures 4.2 through 4.7 show the distribution of data for arsenic, barium, cadmium, copper, lead and zinc respectively. The box plots are based on the means values for each parameter from each landfill. As can be seen, there are no data beyond the applicable groundwater standards for arsenic and copper. These figures agree with the statistical analysis, and these parameters do not appear to pose any problems. The 90th percentiles are below the groundwater standards for

Figure 4.1: Box Plot Example

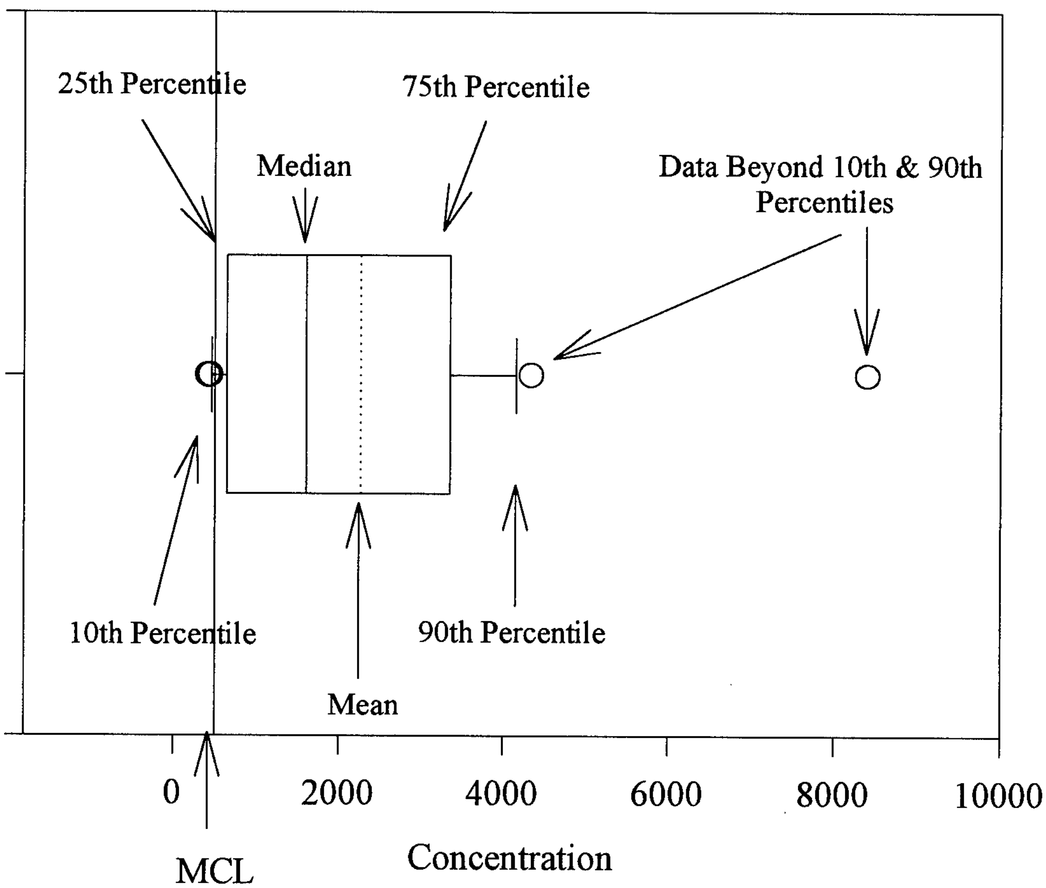


Figure 4.2: Box Plot for Arsenic

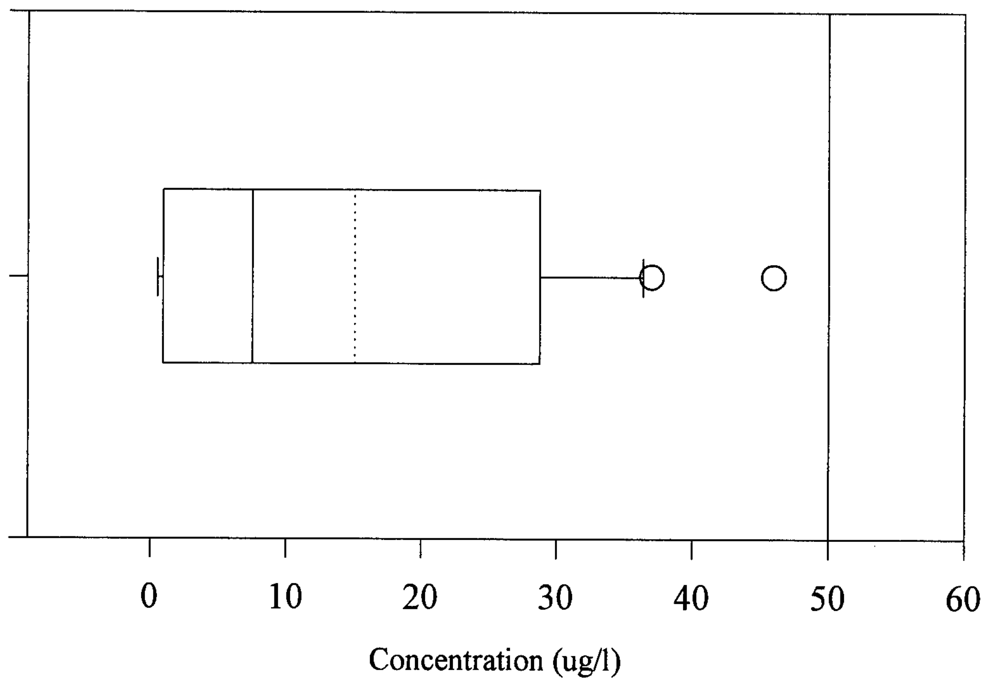


Figure 4.3: Box Plot for Barium

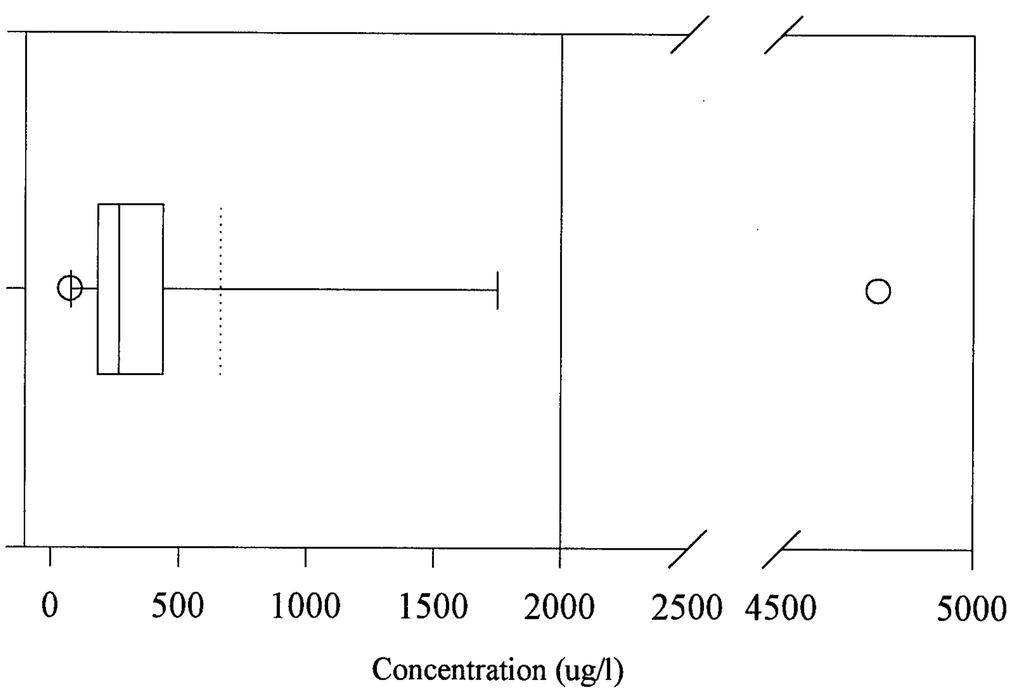


Figure 4.4: Box Plot for Cadmium

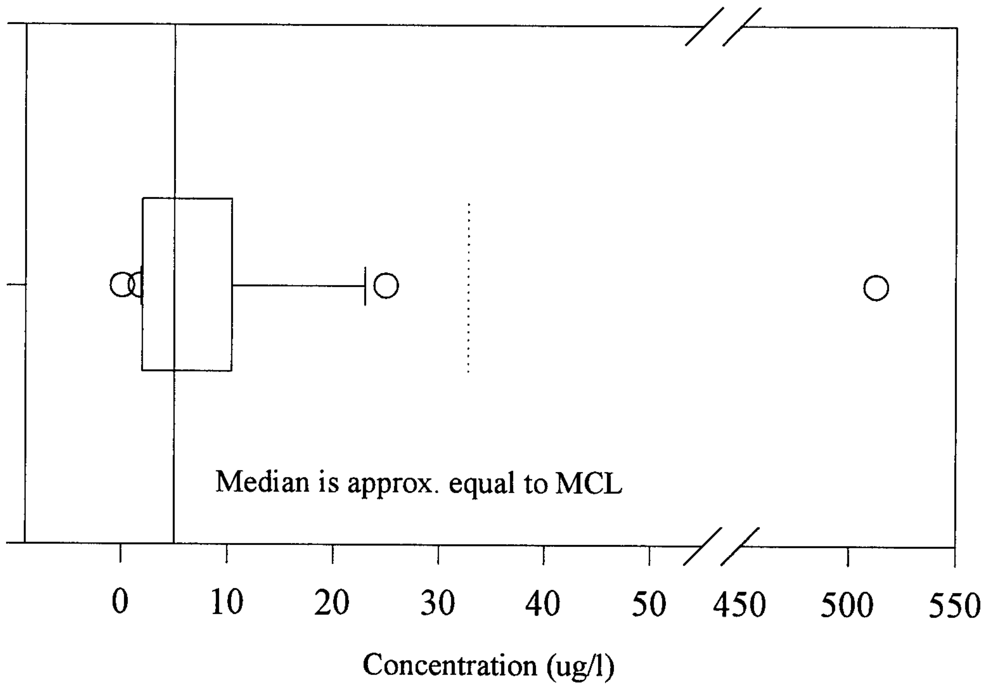


Figure 4.5: Box Plot for Copper

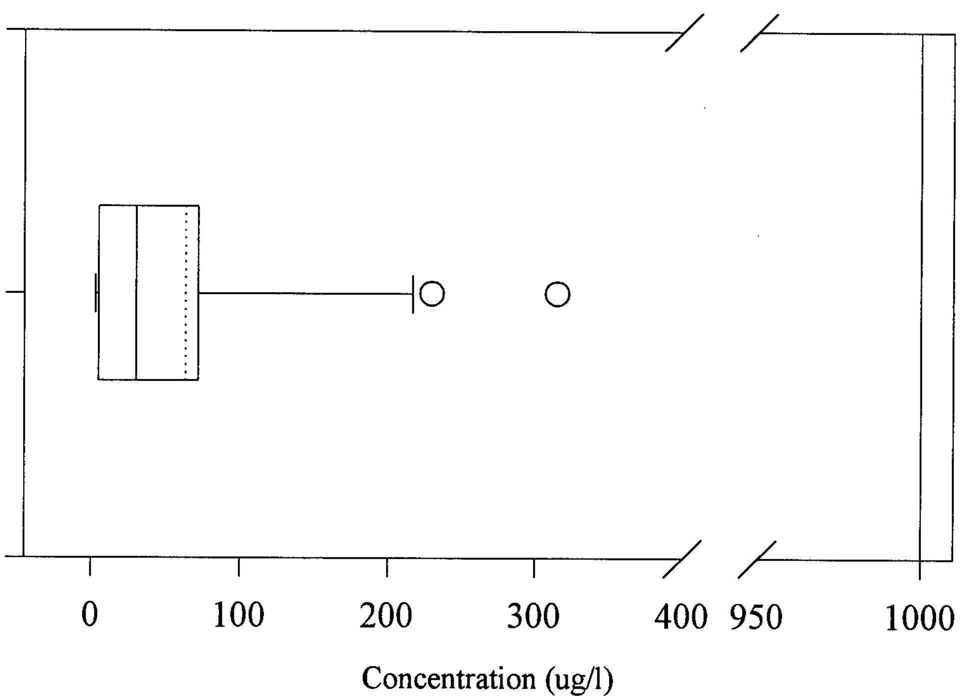


Figure 4.6: Box Plot for Lead

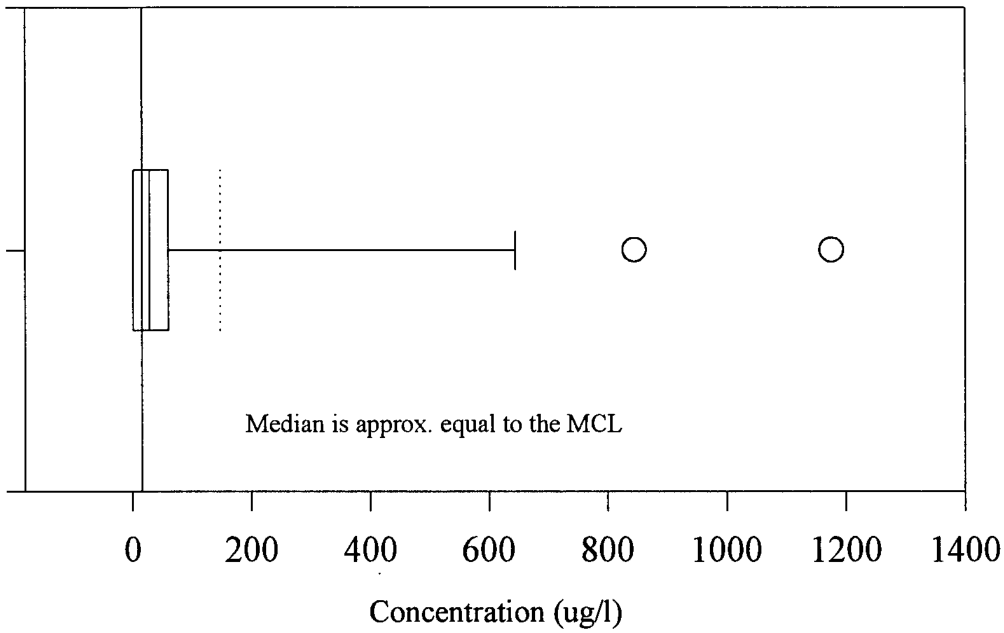
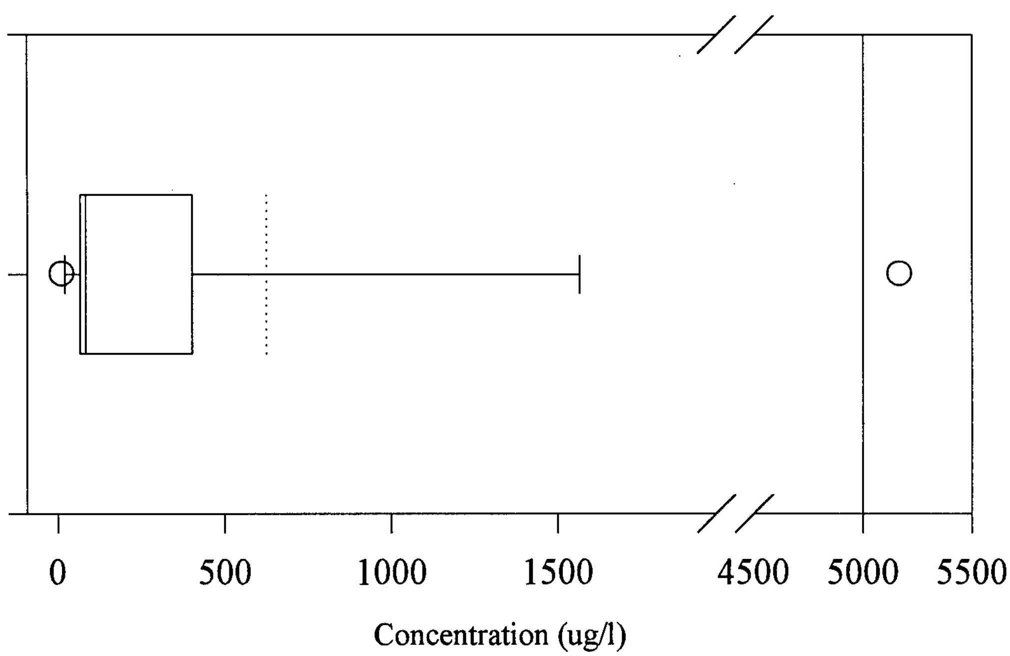


Figure 4.7: Box Plot for Zinc



barium and zinc. Both of these metals have a data point beyond the MCL, but all of the rest of the data are within compliance. The statistical tests for barium and zinc show that the means are below the MCL's with a confidence of 98%. Thus, these metals are also not problems. The box plots for lead and cadmium show that the MCL is exceeded by 50% or more of the data. The median for cadmium is approximately equal to the MCL, therefore, a separate line for the median is not shown on the box plot. The box plots for lead and cadmium support the conclusions of the statistical tests. These metals do pose a risk to human health and the environment.

4.5.2 Other Conclusions

There are some discernible trends in the data for the heavy metals. The Sanifill Landfills (three) of Houston, Texas tested for 10 of the heavy metals. Eight of the highest means came from these landfills. Furthermore, nine of the means were in the top one or two values for the particular metals. The 100 Sand Co. Landfill of New York tested for fourteen of the heavy metals. Only two of the means for this landfill were the highest reported among all of the landfills. Five of the means were in the top one or two values for the particular metals. The remaining landfills either did not have any of the high mean values or had only one of the highest or second highest values. It appears that the Sanifill Landfills of Houston were very contaminated in comparison to the remaining landfills. However, removing the Sanifill Landfills from this study would not have significantly changed the results of the statistical tests. Lead and cadmium were sufficiently high at the other landfills to pose a problem, regardless of the contributions from the Sanifill Landfills.

The source of heavy metal contamination is fairly well documented. Many paints and coating contain lead, mercury, arsenic, and cadmium, chromium, barium, and zinc (EPA 1994). Lead is an additive in caulking and is used in flashing. Cadmium, chromium and arsenic are used to preserve would in various chemical forms. Trace amounts of these metals are also included in common metals used for structural members, flashing, electrical wiring and many other forms of metals commonly used in construction. It is hardly surprising that construction and demolition leachate contains elevated levels of heavy metals, knowing all of the potential sources of heavy metals.

4.6 Conventional Parameters

With a few exceptions, the conventional parameters were sampled frequently. However, not all conventional parameters have established groundwater standards, therefore, a statistical analysis was conducted only on the conventional parameters that have groundwater standards. The maximum and mean concentrations were reported for all parameters that did not have groundwater standards.

Twenty-seven conventional parameters were tested for at least once. A statistical test was not conducted on the following seventeen parameters because they do not have established groundwater standards:

Alkalinity	*Ammonia-N*	*Biological Oxygen Demand*
Calcium	*Chemical Oxygen Demand*	*Hardness*
Magnesium	*Oil & Grease*	*Organic Nitrogen*
Phenols	*Phosphorus*	*Potassium*
Specific Conductance	*Total Organic Carbon*	*Total Organic Halogens*
Total Suspended Solids		

Table 4.5 on the following page summarizes the findings for these parameters, including the results of the statistical analysis. The statistical tests are included in Appendix D. For nitrate and nitrite, the data had to be transformed into the log of the concentration. The statistical analysis was performed on the transformed data, then the results were converted back to the original scale. The confidence intervals were constructed after the data was converted back the original scale.

Ten conventional parameters have established groundwater standards. With one exception, a statistical test was conducted on these parameters. The exception is boron. Only one site, the Sanifill Landfills of Houston, tested for boron. The highest value of boron at these landfills exceeded the groundwater standards. However, because of the lack of supporting data, no conclusions can be drawn about boron. Six of the ten conventional parameters with groundwater standards could pose a risk to human health and the environment. The results of the statistical tests indicate that the means for the following parameters exceed the appropriate groundwater standard:

Chlorides	*Iron*	*Manganese*
Sodium	*Sulfate*	*Total Dissolved Solids*

Table 4.5: Summary of Statistics for Conventional Parameters.

Parameter	Sites that Sampled Parameter	Sites that Detected Parameter	Percent Detected	Max. Conc. Overall[1].	Max. Of Means.[2]	Mean[3]	Primary MCL	Secondary MCL	Guidance Conc.	Confidence Interval	Poses Problem?[4]
Alkalinity	12	12	100%	6520	4115	964.73				NA	NA
Ammonia (N)	17	16	94%	480	138.93	20.42				NA	NA
BOD	14	14	100%	920	530	87.32				NA	NA
Boron	1	1	100%	3.9	2.65	2.65			0.63	NA	NA
Calcium	6	6	100%	600	480	274.3				NA	NA
COD	17	16	94%	11200	7140	754.5				NA	NA
Chlorides	20	20	100%	1400	795.3	157.6		250		(52.7, 262.5)	Yes
Cyanide	13	8	62%	0.34	0.09	0.010	0.2			(0, 0.04)	No
Hardness	9	9	100%	2420	480	274.3				NA	NA
Iron	20	20	100%	5206	275.11	36.76		0.30		(1.8, 71.7)	Yes
Magnesium	6	6	100%	460	224	117.63				NA	NA
Manganese	13	13	100%	258	76.38	8.71		0.050		(0, 23.9)	Yes
Nitrate	12	8	67%	13	8.50	0.45	10			(0.1, 1.7)	No
Nitrite	8	6	75%	0.047	.09	0.06	1			(0.01, 0.5)	No
Oil & Grease	9	7	78%	50	45	15.31				NA	NA
Organic N	10	10	100%	190	20.75	5.70				NA	NA
pH	15	15	100%	8	7.60	6.95		6.5-8.5		(6.7, 7.2)	No
Phenols	7	7	100%	4.9	2.23	0.62				NA	NA
Phosphorus	8	7	88%	3.89	3.20	1.06				NA	NA
Potassium	8	8	100%	618	368	101.33				NA	NA
Sodium	11	11	100%	1290	773	162.63	160			(0, 355.3)	Yes
Specific Conductance	10	10	100%	6850	4885	1666.2				NA	NA
Sulfate	17	16	94%	1700	1126	253.72		250		(0, 443.8)	Yes
Total Dissolved Solids	18	17	94%	8400	8400	2263.1		500		(992, 3534)	Yes
Total Organic Carbon	7	7	100%	2100	926.00	306.54				NA	NA
Total Organic Halogens	4	4	100%	0.91	0.61	0.36				NA	NA
Total Suspended Solids	18	17	94%	43000	22000	1859.1				NA	NA

Notes:
See Notes from Table 4.4.

Iron, manganese and total dissolved solids had means that were dramatically higher than their groundwater standards. There is little doubt that these three parameters will pose a problem. The means for chloride, sodium, and sulfate were only slightly higher than their groundwater standards. Although the statistical test indicates that they could pose a problem, they will pose less of a problem than iron, manganese, and total dissolved solids. Concentrations for chloride, sodium, and sulfate could be less than the applicable standards at groundwater monitoring wells surrounding the C&D landfills. In all cases, the applicable groundwater standard is a secondary standard. Secondary standards are intended to protect water supplies for aesthetic reasons (taste, color) rather than health-based reasons (EPA 1995). This means that although the groundwater could be degraded, there is no increased risk to human health.

4.6.1 Box Plots for Conventional Parameters

Box plots for several conventional parameters of interest have been developed to show the distribution of the data. Figure 4.1 shows a typical box plot. Refer to section 4.5.1 for an explanation of the typical box plot. Figures 4.8 through 4.17 show the distribution of data for ammonia, COD, chlorides, hardness, iron, manganese, sodium, specific conductance, sulfate, and total dissolved solids respectively.

Ammonia, COD, Hardness, and specific conductance do not have established groundwater standards, therefore, the box plots simply show the distribution of the data. Figure 4.8 shows the data for ammonia. The median is less than 5 mg/l and the average is approximately 20 mg/l. The data are grouped into low concentrations and high concentrations as is evident by the box plot. The median and 10th percentile are very close to each other, but the 75th and 90th percentile and spread out and much higher than the median. The average concentration is 20.42 mg/l, which is approximately equal to the 75th percentile. Figure 4.9 shows the data for COD. Again, the data seem to be distributed between high and low values, but the data are not as spread out as ammonia. The median is located around 250 mg/l, with the mean concentration equal to 754.5 mg/l. There are several data points beyond the 90th percentile, with the highest concentration at over 7000 mg/l. Figure 4.11 shows the data for hardness. The data are distributed more evenly, although the median is still toward the lower end of the data. The mean is located at 771.80 mg/l and the median is at approximately 500 mg/l. There are several data points beyond the 90th percentile with the highest concentration being 2114 mg/l. Figure 4.15 shows the data for specific

Figure 4.8: Box Plot for Ammonia-N

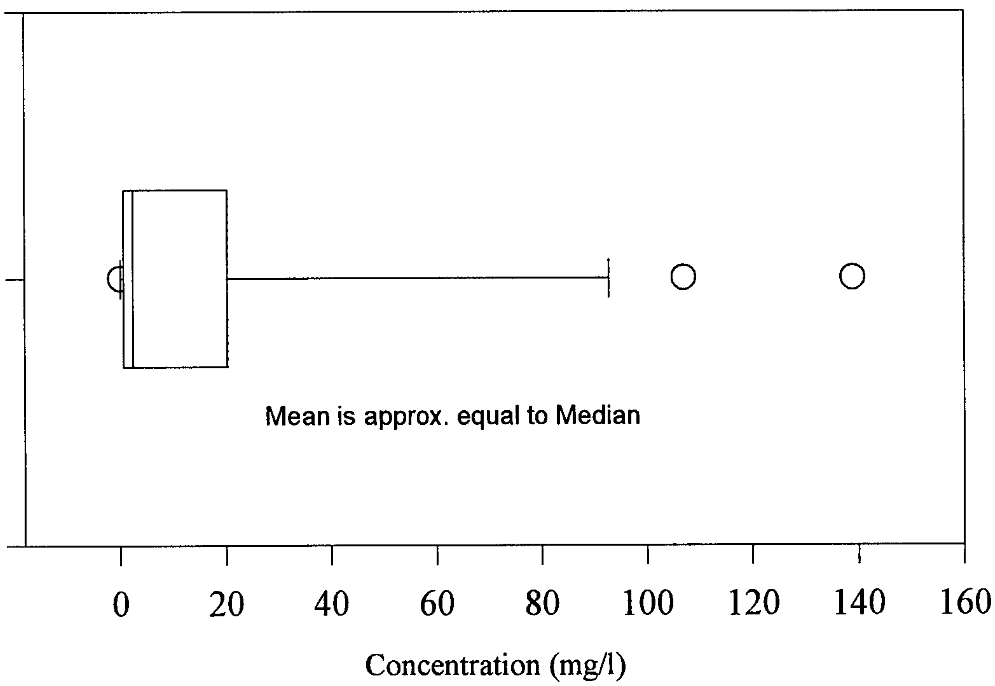


Figure 4.9: Box Plot for Chemical Oxygen Demand

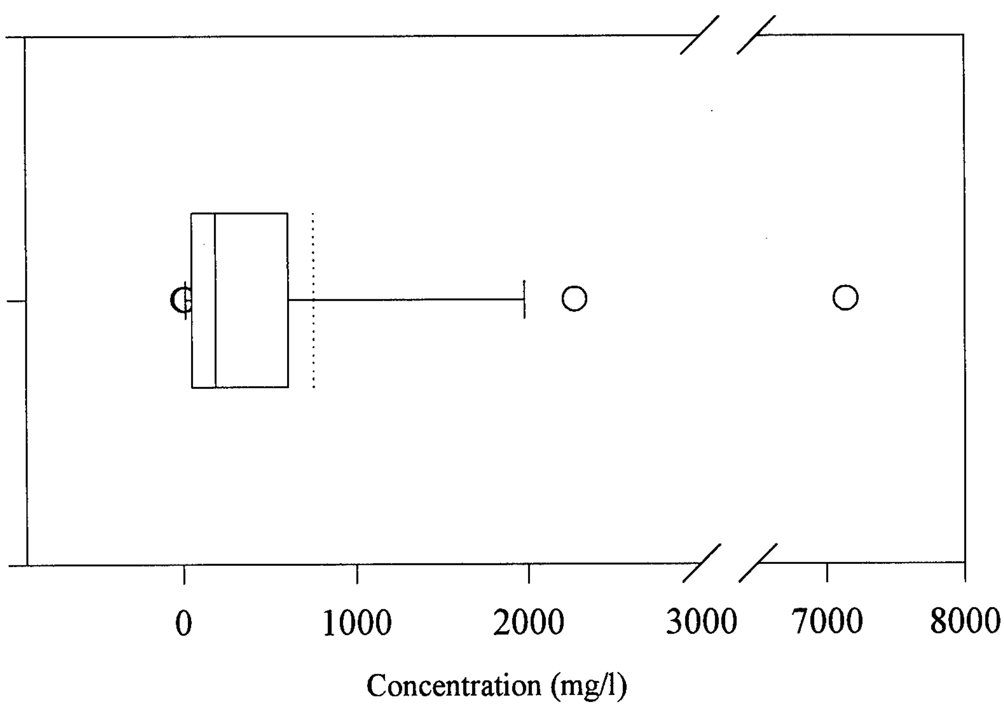


Figure 4.10: Box Plot for Chlorides

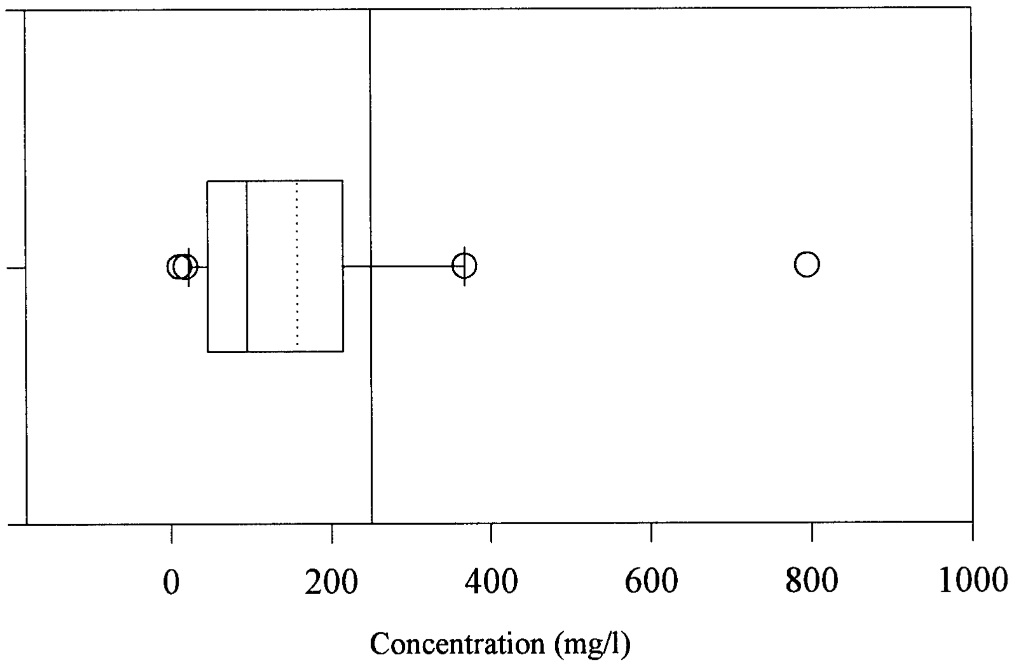


Figure 4.11: Box Plot for Hardness

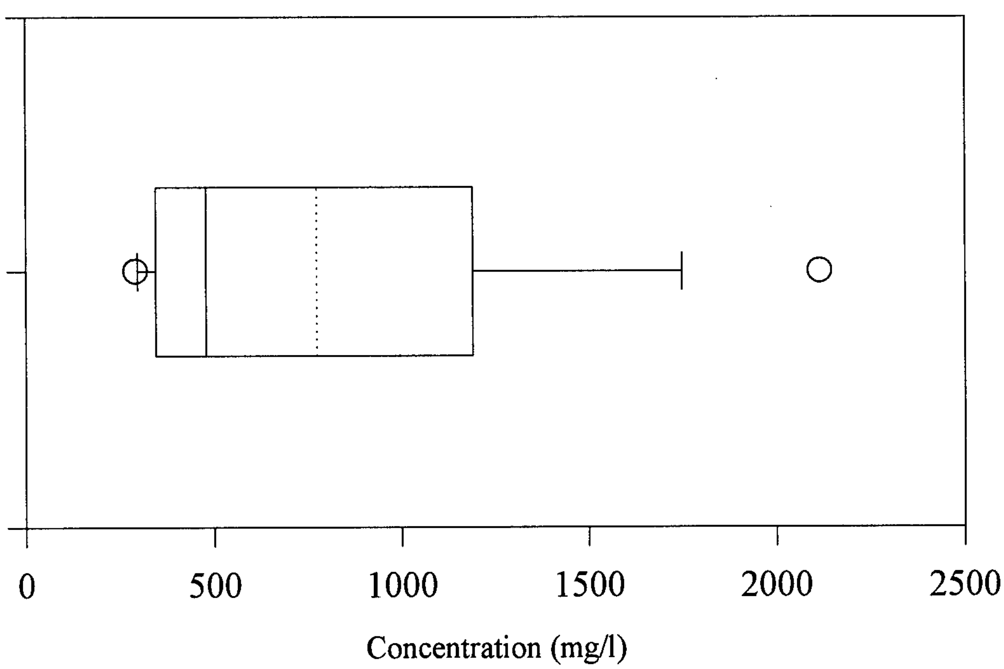


Figure 4.12: Box Plot for Iron

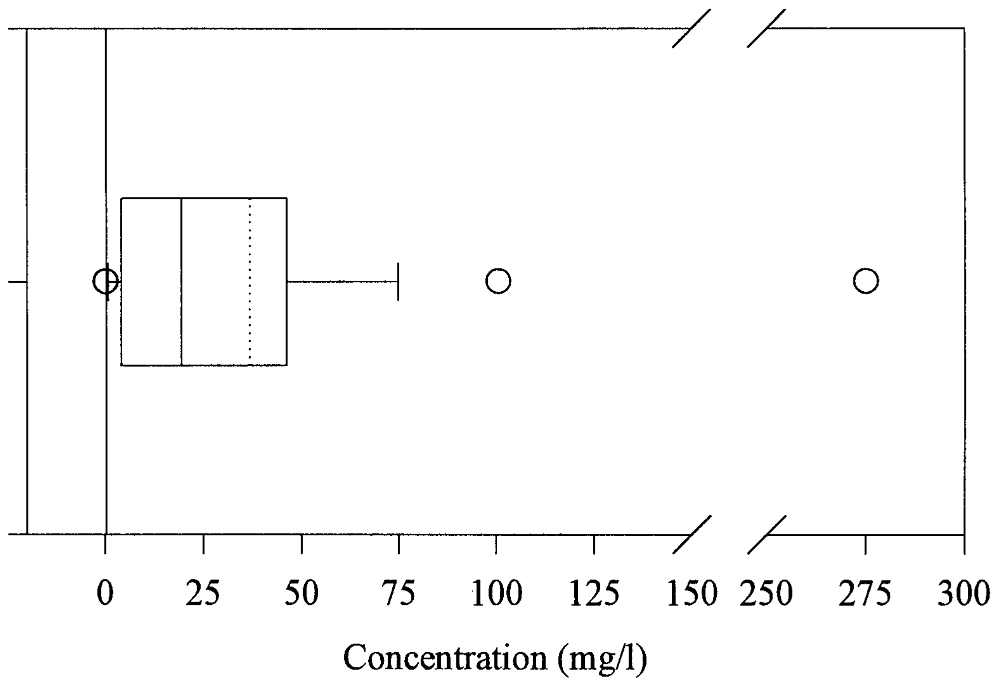


Figure 4.13: Box Plot for Manganese

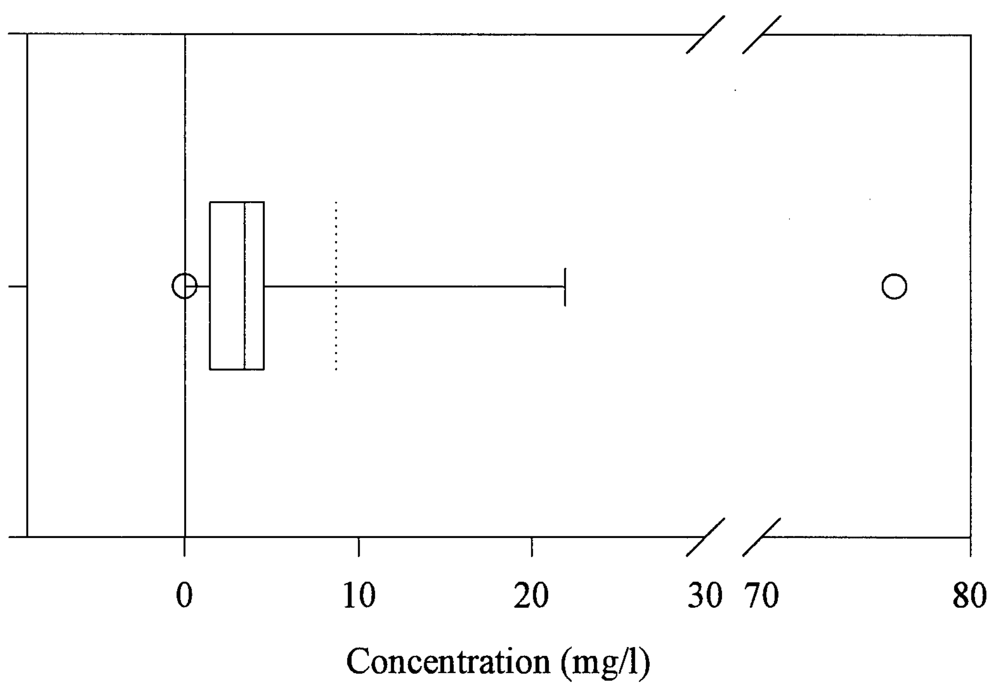


Figure 4.14: Box Plot for Sodium

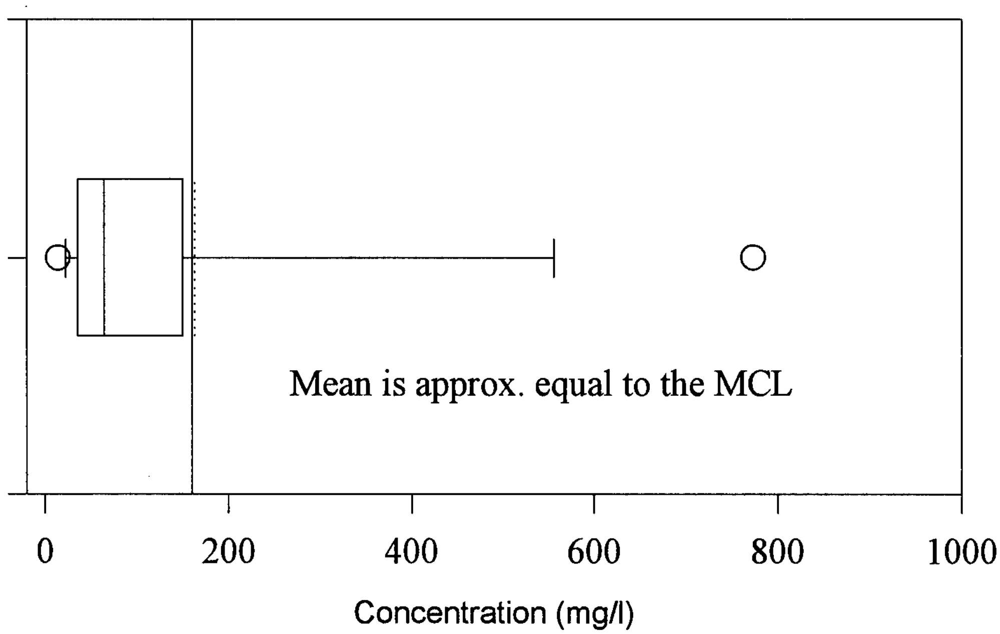


Figure 4.15: Box Plot for Specific Conductance

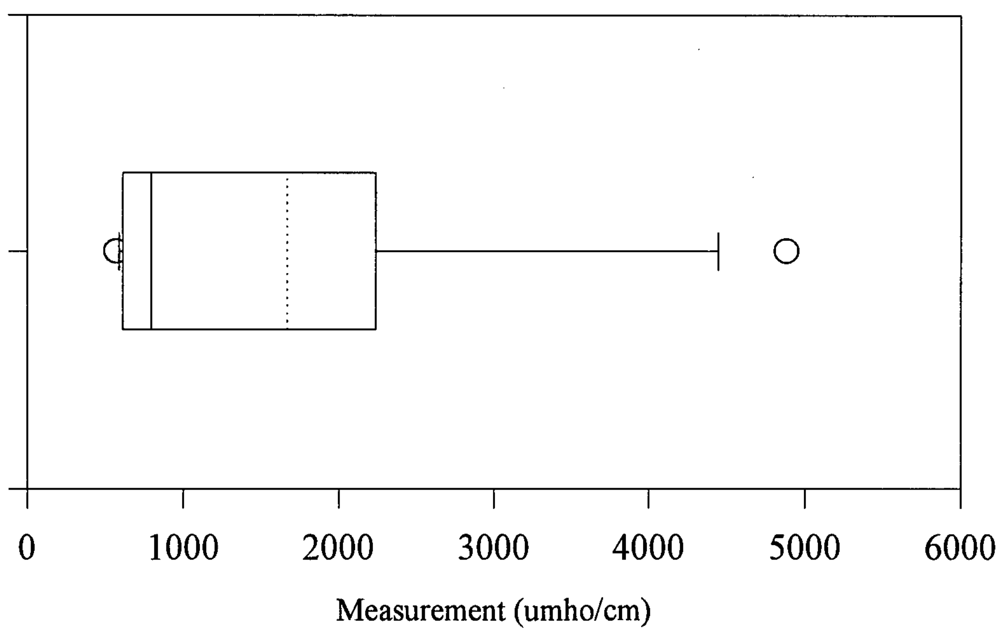


Figure 4.16: Box Plot for Sulfate

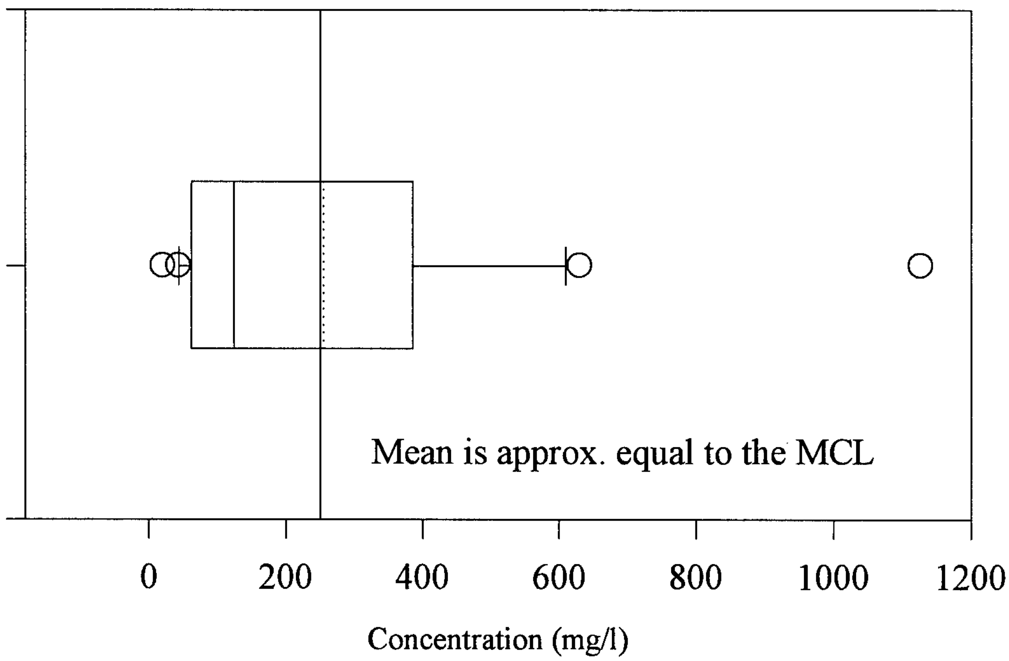
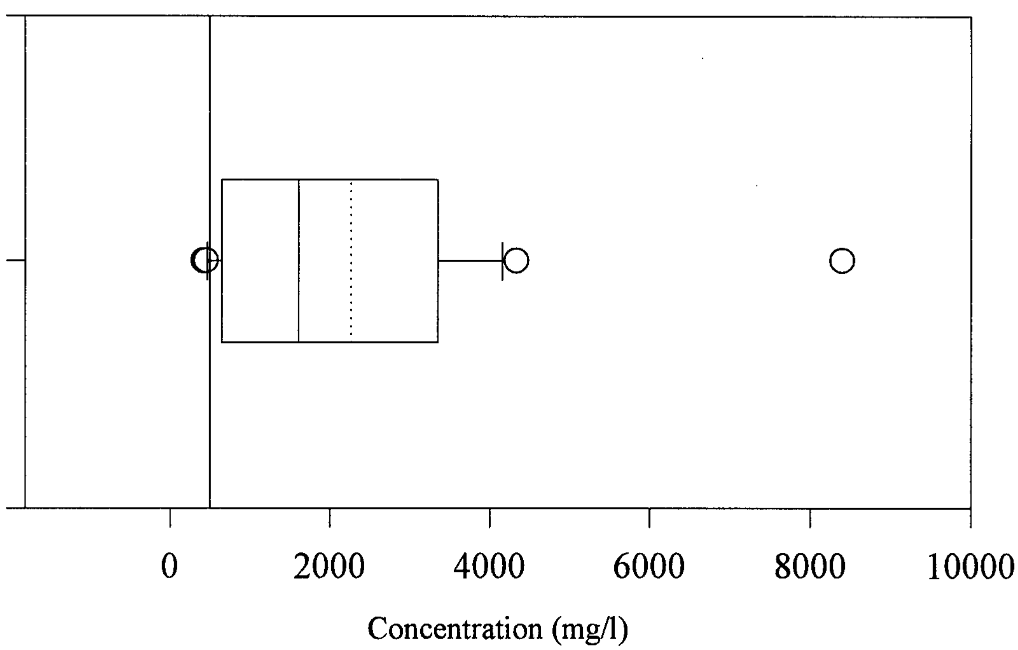


Figure 4.17: Box Plot for Total Dissolved Solids



conductance. Again, the data are distributed between high and low values. The median is located very close to the 10th percentile, and the mean is higher and located closer to the 75th percentile. There are some data points beyond the 90th percentile with the highest concentration being 4885 umho/cm. The mean is equal to 1666.2 umho/cm with the median at approximately 750 umho/cm.

Chloride, iron, manganese, sodium, sulfate, and total dissolved solids have groundwater standards. The standards are shown as the solid line from axis to axis on the box plots. Figure 4.10 shows the data for chlorides. The statistical test for chloride indicates that it is a potential problem. The box plot does not strongly support this conclusion. Over 75% of the data are less than the groundwater standard. The 90th percentile and two other data points are above the standard. Since the statistical test is based on a 98% probability, the statistical test shows that the mean could be equal to or higher than the standard. A review of the box plot would indicate that chloride is mostly within standards. Since the leachate will be diluted by groundwater, it is doubtful whether the groundwater monitoring wells would show that chlorides exceed the standards. Although the statistical test indicates that chloride is a problem, the box plot shows that chloride is more likely to be within standards. More research on chlorides in leachate would clear up this confusion.

Figures 4.12, 4.13 and 4.17 show the data for iron, manganese, and total dissolved solids respectively. There is no doubt that these parameters are problems in C&D leachate. The groundwater standards for all three parameters are at or below the 10th percentile, therefore the vast majority of the data are higher than the standards. The box plots strongly support the conclusions of the statistical tests for these parameters, therefore, iron manganese, and total dissolved solids are present in C&D leachate at levels exceeding the groundwater standards.

Figure 4.14 shows the data for sodium. Like chloride, over 75 percent of the data are less than the applicable standard. The 90th percentile and a data point are above the standard. The statistical test indicates that sodium is a problem, but the box plot does not strongly support this conclusion. There are only three mean values that are over the standard with the highest of 773 mg/l far exceeding the 90th percentile. Although the statistical test indicates that sodium is a problem, the box plot shows that sodium is more likely to be within standards. Further research is

needed to determine whether this highest value is an anomaly or if there is just not enough data in this study to adequately represent the population.

Figure 4.15 shows the data for sulfate. A significant percentage of the data for sulfate exceeds the groundwater standard. The mean of 253.72 mg/l is slightly higher than the standard of 250 mg/l. The 75th and 90th percentiles exceed the standard. The box plot clearly supports the conclusion of the statistical test. Sulfate does pose a problem in C&D leachate.

In conclusion, the box plots show that iron, manganese, total dissolved solids, and sulfate pose problems in C&D leachate. Further research is necessary to determine whether sodium and chloride are actually problems in C&D leachate.

4.6.2 Other Conclusions

There are trends apparent in the data for conventional parameters. Three landfills account for the majority of the highest and second highest mean values seen in the data. The Sanifill Landfills of Houston, Texas, account for 9 of the highest and 6 of the second highest mean values of the conventional parameters. A similar trend was seen in the data for the heavy metals. The Sand Co. Landfill of New York accounts for 4 of the highest and 5 of the second highest mean values. Again, a similar trend was seen in the data for heavy metals. The Massachusetts site accounts for 3 of the highest and 3 of the second highest mean values. A similar trend was seen in the data for volatiles, semi-volatiles and other organic parameters. The remaining landfills either did not have any of the high mean values or had only one of the highest or second highest values. It appears that the Sanifill Landfills of Houston and the Sand Company Landfill were very contaminated in comparison to the remaining landfills.

Removing these landfills from this study would have deleted the data beyond the 90th percentile for both chloride and sodium. This change would have changed the results of the statistical tests. The confidence interval for chloride would be (59.58, 188.58), which does not contain the groundwater standard of 250 mg/l. The confidence interval for sodium would be (0, 111.11), which does not contain the groundwater standard of 160 mg/l. The statistical tests would indicate that chloride and sodium are not problems. This conclusion is more in line with the data shown in the box plots for these parameters. It gives more evidence that the statistical test is too conservative and sodium and chloride are probably not problems in C&D leachate.

Removing these landfills from the study would not have changed the conclusions reached concerning iron, manganese, total dissolved solids, and sulfate. Iron, manganese, and sulfate were sufficiently high at the other landfills to pose a problem, regardless of the contributions from the Sanifill Landfills and Sand Co. Landfill. The highest concentrations for sulfate were seen at other landfills, therefore, removing these landfills from the study would not have changed the results of the statistical test.

The conventional parameters are normally seen in municipal landfills, therefore, it is not surprising that the conventional parameters are seen in C&D leachate. Iron and manganese are present in a large percentage of the metals disposed of at C&D waste landfills. Sulfate is a constituent of the gypsum drywall that makes up a significant portion of C&D waste (EPA 1994). Sodium, potassium, calcium, and chloride can leach from concrete and cement compounds (Goumans 1991). Decaying organic matter such as cardboard, paper, and vegetation will produce elevated levels of COD and ammonia. The literature sources have not attempted to explain the high level of total dissolved solids explicitly. However, C&D waste often includes a large portion of fines. Fines may include dirt, crushed drywall, wood, paint products, and concrete. As particle size decreases, chemicals such as sodium, calcium, potassium, and chromium will leach into liquids more readily (Goetz and Glaseker 1991). The smaller particle size of the fines could contribute to the higher content of dissolved solids.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the results of the statistical analysis, and box plots for selected parameters, the following parameters in C&D leachate could present a risk to human health and the environment because they exceed either primary groundwater standards or guidance concentrations that are based on health risks:

Methylene Chloride *1,2-Dichloroethane* *Cadmium* *Lead*

The data indicate that some degradation of groundwater could occur because of the presence of these contaminants. It cannot be determined from this study how far the contaminants will spread from a disposal site or if the levels of these contaminants are high enough to contaminant groundwater monitoring wells.

The data show that the following parameters should exceed secondary groundwater standards:

iron *manganese* *total dissolved solids* *sulfate*

Groundwater in the vicinity of C&D landfills will be degraded. There is a high probability that groundwater monitoring wells will contain iron, manganese, and total dissolved solids in excess of the groundwater standards because of the extremely high levels of these contaminants in C&D leachate. It cannot be determined if the levels of sulfate present in C&D leachate are high enough to contaminant groundwater monitoring wells. It should be noted that while the concerns regarding leachate generated from C&D waste landfills has resulted from contaminants resulting from hazardous waste, contamination may also result from the "clean" fraction of the C&D waste stream.

5.2 Recommendations

Regulators at the EPA proposed standards for non-municipal solid waste facilities in May 1995. The standards include the minimum criteria of location restrictions, groundwater monitoring as necessary to detect contamination, and corrective action (Federal Register 1995). Regulators believe that C&D facilities, in general, do not pose significant risks to the environment. The proposed standards are sufficient to minimize risk to the environment with one exception. This investigator feels there is sufficient evidence that leachate produced from C&D

landfills could degrade groundwater in the immediate vicinity of the site and that several contaminants could pose a risk to human health and the environment. Because of the risk for damage to human health and the environment, C&D waste landfills should be required to prove that they have the financial resources to mitigate any damage caused by the C&D waste landfill. Requiring financial assurance would eliminate operators that do not have the financial resources to correct damage caused by the landfill. The final standards for non-municipal solid waste facilities should require financial assurance.

Because there are insufficient data concerning volatile organics, semi-volatile organics, and other organics such as pesticides and herbicides, further research is required to determine if these classes of contaminants are present in sufficient amounts to endanger human health and the environment. Further research is also required to determine whether sodium and chlorides are actually present in C&D leachate in quantities exceeding the applicable secondary groundwater standards. Until more research is conducted, operators of C&D waste landfills should conduct, at a minimum, annual testing for volatiles, semi-volatiles and other organics to ensure that these contaminants are not entering the groundwater.

WORKS CITED

Folkenburg, Jan, and Benthe Rasmussen. "Leaching from Building Waste." Waste Materials in Construction. Eds. J. J. J. R. Goumans, H. A. van der Sloot, and Th. G. Aalbers. Hamburg: Elsevier Science Publishers, 1991. 365-367.

Goetz, D., and W. Glaseker. "Effect of Particle Size Distribution on Leaching Properties of Building Materials." Waste Materials in Construction. Eds. J. J. J. R. Goumans, H. A. van der Sloot, and Th. G. Aalbers. Hamburg: Elsevier Science Publishers, 1991. 283-292.

Hamel, Maurice. Water Compliance Unit of the Connecticut Department of Environmental Protection. Bulky Waste Leachate Characterization Survey. Hartford: 1989.

Interpoll Laboratories Inc.. Potential for Environmental Impairment at the SKB Rich Valley Demolition Waste Management Facility. St. Paul, Minnesota: 1992.

National Association of Demolition Contractors. C&D Waste Landfills, Leachate Quality Data, Volumes I and II. Falls Church, Virginia: 1994.

Norstrom, James M., Charles E. Williams, and Paul A. Pabor. "Properties of Leachate from Construction/Demolition Waste Landfills." Proceedings Fourteenth Annual Madison Waste Conference, 25-26 September 1991. Madison: Department of Engineering Professional Development, University of Wisconsin-Madison, 1991.

Ott, R. Lyman. An Introduction to Statistical Methods and Data Analysis. Belmont, California: Duxbury Press, 1992.

Rankers, R. H., and I. Hohberg. "Leaching Tests for Concrete Containing Fly Ash - Evaluation and Mechanism." Waste Materials in Construction. Eds. J. J. J. R. Goumans, H. A. van der Sloot, and Th. G. Aalbers. Hamburg: Elsevier Science Publishers, 1991. 275-282.

Spencer, Robert. "Taking Control of C&D Debris." Biocycle. Jul 1994: 65-67.

Tchobanoglous, George, Hilary Theisen, and Samuel Vigil. Integrated Solid Waste Management: Engineering Principles and Management Issues. New York: McGraw-Hill, 1993.

United States. Code of Federal Regulations. Title 40 - Protection of the Environment. Parts 261-264. Washington D.C.: GPO, 1994.

--. Environmental Protection Agency, Environmental Monitoring and Support Laboratory. Methods for Chemical Analysis of Water and Wastes. EPA-600. Cincinnati: GPO, 1979.

---. Environmental Protection Agency, Office of Solid Waste. Addenda to Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities. PB89-151047. Springfield: U.S. Department of Commerce, National Technical Information Service, 1992.

---. Environmental Protection Agency, Office of Solid Waste. Construction and Demolition Waste Landfills. PB95-208906. Washington D.C.: 1995.

---. Environmental Protection Agency, Office of Solid Waste. Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities. PB89-151047. Springfield: U.S. Department of Commerce, National Technical Information Service, 1989.

---. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. SW-846. Washington D.C.: GPO, 1986.

---. Florida Department of Environmental Protection, Division of Water Facilities. Ground Water Guidance Concentrations. N.p.: Bureau of Drinking Water and Ground Water Resources, 1994.

---. "Proposed Standards for Nonmunicipal Solid Waste Landfills, 40 CFR Parts 257, 261, and 271." Federal Register. Washington D.C.: GPO, May 1995.

Waste Management of North America, Inc. Construction and Demolition Landfill Leachate Characterization Study. Naperville, Illinois: 1993.

APPENDIX A:
SUMMARY OF LANDFILLS
&
SAMPLING DATA

APPENDIX B:
TEST METHODS
&
METHOD DETECTION LIMITS

APPENDIX C:
PROBABILITY PLOTS

APPENDIX D:
STATISTICAL TESTS

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APPENDIX A:

SUMMARY OF LANDFILLS
&
SAMPLING DATA

Table A.1. Characteristics of the Armetta Landfill of Connecticut.

LANDFILL:	Armetta Landfill.
OWNER/OPERATOR:	Unknown
LITERATURE SOURCE:	Construction and Demolition Waste Landfills. Prepared by ICF Incorporated for the U.S. Environmental Protection Agency, Office of Solid Waste.
WASTE TYPE:	Demolition debris and landclearing debris.
ACREAGE:	Unknown.
YEARS IN SERVICE:	Unknown.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	Unknown.
MISCELLANEOUS:	None.

Table A.2: Sampling for the Armetta Landfill of Connecticut.

	Sample 1			Sample 2			Sample 3			Primary	Secondary	Guidance
	Result		Det Limit	Result		Det Limit	Result		Det Limit	MCL	MCL	Conc
Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acetone		NS			NS			NS				700.00
2-Butanone		NS			NS			NS				4200.00
Carbon Disulfide		NS			NS			NS				700.00
Chloromethane		NS			NS			NS				2.70
1,1-Dichloroethane		NS			NS			NS				700.00
1,2-Dichloroethane		NS			NS			NS		3.00		
1,4-Dioxane		NS			NS			NS				5.00
Ethylbenzene		NS			NS			NS			700.00	
Methyl Ethyl Ketone (MEK)		NS			NS			NS				4200.00
4-Methyl-2-Pentanone		NS			NS			NS				
Methylene Chloride		NS			NS			NS		5.00		
Toluene		NS			NS			NS		1000.00		
1,1,1 Trichloroethane		NS			NS			NS		200.00		
Trichloroethylene		NS			NS			NS		3.00		
Trichlorofluoromethane		NS			NS			NS				2100.00
Xylenes (Total)		NS			NS			NS		10000.00		
Semi-Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acenaphthene		NS			NS			NS				20.00
Acetophenone		NS			NS			NS				700.00
Benzene		NS			NS			NS		1.00		
Benzoic Acid		NS			NS			NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS			NS			NS				
2,4-Dimethylphenol		NS			NS			NS				400.00
Di-n-Butyl phthalate		NS			NS			NS				700.00
Diethyl Phthalate		NS			NS			NS				5600.00
Fluoranthene		NS			NS			NS				280.00
Napthalene		NS			NS			NS				6.80
m&p-Creosol		NS			NS			NS				35.00
o-Creosol		NS			NS			NS				350.00
Phenathrene		NS			NS			NS				10.00
Phenol		NS			NS			NS				10.00
Pyrene		NS			NS			NS				210.00
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Alpha-BHC		NS			NS			NS				0.05
Endrin		NS			NS			NS		2.00		
Dieldrin		NS			NS			NS				0.10
Dimethoate		NS			NS			NS				5.00
Disulfoton		NS			NS			NS				0.50
2,4,5-T		NS			NS			NS				70.00
2,4-D		NS			NS			NS		70.00		
HxCDD		NS			NS			NS				
HxCDF		NS			NS			NS				
Heavy Metals	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Antimony		NS			NS			NS		6.00		
Arsenic		NS			NS			NS		50.00		
Barium		NS			NS			NS		2000.00		
Cadmium	10.00			30.00			20.00			5.00		
Chromium		ND		120.00			60.00			100.00		
Copper	50.00			440.00			200.00			1000.00		
Lead	40.00			360.00			110.00			15.00		
Mercury		NS			NS			NS		2.00		
Nickel	90.00			170.00			100.00			100.00		
Selenium		NS			NS			NS		50.00		
Silver		NS			NS			NS			100.00	
Thallium		NS			NS			NS		2.00		
Vanadium		NS			NS			NS				49.00
Zinc	240.00			2600.00			610.00				5000.00	

182

2,4-D		NS			NS			NS		70.00		
HxCDD		NS			NS			NS				
HxCDF		NS			NS			NS				
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		NS			NS			NS		6.00		
Arsenic		NS			NS			NS		50.00		
Barium		NS			NS			NS		2000.00		
Cadmium	10.00			30.00			20.00			5.00		
Chromium		ND		120.00			60.00			100.00		
Copper	50.00			440.00			200.00			1000.00		
Lead	40.00			360.00			110.00			15.00		
Mercury		NS			NS			NS		2.00		
Nickel	90.00			170.00			100.00			100.00		
Selenium		NS			NS			NS		50.00		
Silver		NS			NS			NS			100.00	
Thallium		NS			NS			NS		2.00		
Vanadium		NS			NS			NS				49.00
Zinc	240.00			2600.00			610.00				5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand		NS			NS			NS				
Chemical Oxygen Demand	330.00			880.00			605.00	NS				
Chlorides	80.00			140.00			110.00				250.00	
Cyanide		NS			NS			NS		0.20		
Ammonia, Nitrogen	2.00			11.00			2.00					
Organic Nitrogen	5.00			11.00			5.00					
Nitrate	0.04			0.44			0.24			10.00		
Nitrite	0.01			0.01			0.01			1.00		
Iron	1.10			10.00			5.50				0.30	
Oil and Grease		NS			NS			NS				
pH		NS			NS			NS			6.5-8.5	
Phenols (Total)		NS			NS			NS				
Phosphorus		NS			NS			NS				
Total Suspended Solids	15.00			490.00			245.00					
Total Dissolved Solids	2700.00			4200.00			3450.00				500.00	
Sulfate		NS			NS			NS			250.00	
Total Organic Carbon		NS			NS			NS				
TOC (Duplicate)		NS			NS			NS				
Total Organic Halogens		NS			NS			NS				
Magnesium		NS			NS			NS				
Mangenese	1.20			1.50			1.80				0.05	
Potassium		NS			NS			NS				
Sodium		NS			NS			NS		160.00		
Alkalinity	750.00			1200.00			1050.00					
Calcium		NS			NS			NS				
Hardness		NS			NS			NS				
Boron		NS			NS			NS				0.63
Specific Conductance (umho/cm)	24000.00			25000.00			24500.00					

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.3: Characteristics of the Blydenburg Cleanfill Landfill of New York.

LANDFILL:	Blydenburg Cleanfill Landfill, New York.
OWNER/OPERATOR:	Town of Islip Resource Recovery Agency 40 Nassau Avenue Islip, New York 11751
LITERATURE SOURCE:	New York State Department of Environmental Conservation Presented in C&D Waste Landfills, Leachate Quality Data, Volume 1. Prepared by Gershman, Brickner & Bratton, Inc. For the National Association of Demolition Contractors.
WASTE TYPE:	Demolition debris and landclearing debris. Known as "Clean Fill".
ACREAGE:	12 acres.
YEARS IN SERVICE:	Unknown.
LINER SYSTEM:	Yes.
LEACHATE SYSTEM:	Yes.
LEACHATE SAMPLE:	Leachate sample taken from leachate collection system.
MISCELLANEOUS:	None.

Table A.4: Sampling for the Blydenburg Cleanfill of New York

	Aug-92			Nov-92			Feb-93			Aug-93			Primary	Secondary	Guidance
	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	MCL	MCL	Conc
Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acetone		NS			NS			NS			NS				700.00
2-Butanone		NS			NS			NS			NS				4200.00
Carbon Disulfide		NS			NS			NS			NS				700.00
Chloromethane		NS			NS			NS			NS				2.70
1,1-Dichloroethane		NS			NS			NS			NS				700.00
1,2-Dichloroethane		NS			NS			NS			NS		3.00		
1,4-Dioxane		NS			NS			NS			NS				5.00
Ethylbenzene		NS			NS			NS			NS			700.00	
Methyl Ethyl Ketone (MEK)		NS			NS			NS			NS				4200.00
4-Methyl-2-Pentanone		NS			NS			NS			NS				
Methylene Chloride		NS			NS			NS			NS		5.00		
Toluene		NS			NS			NS			NS		1000.00		
1,1,1-Trichloroethane		NS			NS			NS			NS		200.00		
Trichloroethylene		NS			NS			NS			NS		3.00		
Trichlorofluoromethane		NS			NS			NS			NS				2100.00
Xylenes (Total)		NS			NS			NS			NS		10000.00		
Semi-Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acenaphthene		NS			NS			NS			NS				20.00
Acetophenone		NS			NS			NS			NS				700.00
Benzene		NS			NS			NS			NS		1.00		
Benzoic Acid		NS			NS			NS			NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS			NS			NS			NS				
2,4-Dimethylphenol		NS			NS			NS			NS				400.00
Di-n-Butyl phthalate		NS			NS			NS			NS				700.00
Diethyl Phthalate		NS			NS			NS			NS				5600.00
Fluoranthene		NS			NS			NS			NS				280.00
Napthalene		NS			NS			NS			NS				6.80
m&p-Creosol		NS			NS			NS			NS				35.00
o-Creosol		NS			NS			NS			NS				350.00
Phenathrene		NS			NS			NS			NS				10.00
Phenol		NS			NS			NS			NS				10.00
Pyrene		NS			NS			NS			NS				210.00
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Alpha-BHC		NS			NS			NS			NS				0.05
Endrin		NS			NS			NS			NS		2.00		
Dieldrin		NS			NS			NS			NS				0.10
Dimethoate		NS			NS			NS			NS				5.00
Disulfoton		NS			NS			NS			NS				0.50
2,4,5-T		NS			NS			NS			NS				70.00
2,4-D		NS			NS			NS			NS		70.00		
HxCDD		NS			NS			NS			NS				
HxCDF		NS			NS			NS			NS				
Heavy Metals	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Antimony		NS			NS			NS			NS		6.00		
Arsenic		NS			NS			NS			NS		50.00		
Barium		NS			NS			NS			NS		2000.00		
Cadmium		ND	1.00	2050.00				ND	1.00		ND	1.00	5.00		
Chromium		NS			NS			NS			NS		100.00		
Copper		NS			NS			NS			NS		1000.00		
Lead	2.00			669.00			25.00			11.00			15.00		
Mercury		NS			NS			NS			NS		2.00		
Nickel		NS			NS			NS			NS		100.00		
Selenium		NS			NS			NS			NS		50.00		
Silver		NS			NS			NS			NS			100.00	
Thallium		NS			NS			NS			NS		2.00		
Vanadium		NS			NS			NS			NS				49.00
Zinc		NS			NS	10.00		NS	10.00	10.00	NS			5000.00	

182

Dieldrin		NS			NS			NS			NS				0.10
Dimethoate		NS			NS			NS			NS				5.00
Disulfoton		NS			NS			NS			NS				0.50
2,4,5-T		NS			NS			NS			NS				70.00
2,4-D		NS			NS			NS			NS		70.00		
HxCDD		NS			NS			NS			NS				
HxCDF		NS			NS			NS			NS				
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		NS			NS			NS			NS		6.00		
Arsenic		NS			NS			NS			NS		50.00		
Barium		NS			NS			NS			NS		2000.00		
Cadmium		ND	1.00	2050.00				ND	1.00		ND	1.00	5.00		
Chromium		NS			NS			NS			NS		100.00		
Copper		NS			NS			NS			NS		1000.00		
Lead	2.00			669.00			25.00			11.00			15.00		
Mercury		NS			NS			NS			NS		2.00		
Nickel		NS			NS			NS			NS		100.00		
Selenium		NS			NS			NS			NS		50.00		
Silver		NS			NS			NS			NS			100.00	
Thallium		NS			NS			NS			NS		2.00		
Vanadium		NS			NS			NS			NS				49.00
Zinc		NS			NS	10.00		NS	10.00	10.00	NS			5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand		NS			NS			NS			NS				
Chemical Oxygen Demand	78.50			202.40			200.00			508.00					
Chlorides	100.00			143.00			77.50			1150.00				250.00	
Cyanide		NS			NS			NS			NS		0.20		
Ammonia, Nitrogen	0.12			1.17			1.17			10.60					
Organic Nitrogen		NS			NS			NS			NS				
Nitrate	0.13				ND	0.01		ND	0.01	0.50			10.00		
Nitrite		NS			NS			NS			NS		1.00		
Iron	0.12			93.40			17.52			1.49				0.30	
Oil and Grease		NS			NS			NS			NS				
pH	6.90			6.50			6.20			6.80				6.5-8.5	
Phenols (Total)	0.01			0.01			0.03				ND	0.01			
Phosphorus		NS			NS			NS			NS				
Total Suspended Solids		NS			NS			NS			NS				
Total Dissolved Solids	702.00			1428.00			1110.00			2040.00				500.00	
Sulfate	211.00			225.00			310.00			11.70				250.00	
Total Organic Carbon		ND	1.00	82.00			105.00			19.00					
TOC (Duplicate)		NS			NS			NS			NS				
Total Organic Halogens		NS			NS			NS			NS				
Magnesium	1.92			5.29			40.23			122.00					
Mangenese	7.61			258.00			21.99			17.90				0.05	
Potassium	0.24			17.60			77.93			112.00					
Sodium	25.70			100.00			49.20			233.00			160.00		
Alkalinity	300.00			663.00			548.00			1480.00					
Calcium		ND	0.03	136.00			124.00			96.40					
Hardness	340.00			840.00				NS		2420.00					
Boron		NS			NS			NS			NS				0.63
Specific Conductance (umho/cm)	1060.00			2010.00			1000.00			1600.00					

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

202

Table A.5: Characteristics of the Construction Disposal Inc. Landfill of Colorado.

LANDFILL:	Construction Disposal, Inc. (CDI) landfill, Adams County, Colorado.
OWNER/OPERATOR:	Construction Disposal Incorporated 9450 Monaco Street Henderson, Colorado 80640
LITERATURE SOURCE:	Hazardous Materials and Waste Management Division Colorado Department of Health Presented in C&D Waste Landfills, Leachate Quality Data, Volume 1. Prepared by Gershman, Brickner & Bratton, Inc. For the National Association of Demolition Contractors.
WASTE TYPE:	Demolition debris and landclearing debris.
ACREAGE:	Unknown.
YEARS IN SERVICE:	Unknown.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	Leachate sample taken from spring water discharge culvert.
MISCELLANEOUS:	None.

Table A.6: Sampling for the Construction Disposal Inc. Landfill of Colorado.

	9/30/92 Result		Det Limit	Primary MCL	Secondary MCL	Guidance Conc
Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acetone		NS				700.00
2-Butanone		NS				4200.00
Carbon Disulfide		NS				700.00
Chloromethane		NS				2.70
1,1-Dichloroethane		NS				700.00
1,2-Dichloroethane		NS		3.00		
1,4-Dioxane		NS				5.00
Ethylbenzene		NS			700.00	
Methyl Ethyl Ketone (MEK)		NS				4200.00
4-Methyl-2-Pentanone		NS				
Methylene Chloride		NS		5.00		
Toluene		NS		1000.00		
1,1,1 Trichloroethane		NS		200.00		
Trichloroethylene		NS		3.00		
Trichlorofluoromethane		NS				2100.00
Xylenes (Total)		NS		10000.00		
Semi-Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acenaphthene		NS				20.00
Acetophenone		NS				700.00
Benzene		NS		1.00		
Benzoic Acid		NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS				
2,4-Dimethylphenol		NS				400.00
Di-n-Butyl phthalate		NS				700.00
Diethyl Phthalate		NS				5600.00
Fluoranthene		NS				280.00
Napthalene		NS				6.80
m&p-Creosol		NS				35.00
o-Creosol		NS				350.00
Phenathrene		NS				10.00
Phenol		NS				10.00
Pyrene		NS				210.00
Herbicides/Pesticides	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Alpha-BHC		NS				0.05
Endrin		NS		2.00		
Dieldrin		NS				0.10
Dimethoate		NS				5.00
Disulfoton		NS				0.50
2,4,5-T		NS				70.00
2,4-D		NS		70.00		
HxCDD		NS				
HxCDF		NS				
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		NS		6.00		
Arsenic		NS		50.00		
Barium		NS		2000.00		
Cadmium		NS		5.00		
Chromium		NS		100.00		
Copper		NS		1000.00		
Lead		NS		15.00		
Mercury		NS		2.00		
Nickel		NS		100.00		
Selenium		NS		50.00		
Silver		NS			100.00	

1082

Disulfoton		NS				0.50
2,4,5-T		NS				70.00
2,4-D		NS		70.00		
HxCDD		NS				
HxCDF		NS				
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		NS		6.00		
Arsenic		NS		50.00		
Barium		NS		2000.00		
Cadmium		NS		5.00		
Chromium		NS		100.00		
Copper		NS		1000.00		
Lead		NS		15.00		
Mercury		NS		2.00		
Nickel		NS		100.00		
Selenium		NS		50.00		
Silver		NS			100.00	
Thallium		NS		2.00		
Vanadium		NS				49.00
Zinc		NS			5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand		NS				
Chemical Oxygen Demand		ND	5.00			
Chlorides	56.70				250.00	
Cyanide		NS		0.20		
Ammonia, Nitrogen		NS				
Organic Nitrogen		NS				
Nitrate		NS		10.00		
Nitrite		NS		1.00		
Iron	0.05				0.30	
Oil and Grease		ND	1.00			
pH	7.24				6.5-8.5	
Phenols (Total)		NS				
Phosphorus		NS				
Total Suspended Solids		ND	5.00			
Total Dissolved Solids		NS			500.00	
Sulfate	118.00				250.00	
Total Organic Carbon		NS				
TOC (Duplicate)		NS				
Total Organic Halogens		NS				
Magnesium	15.00					
Mangenese	0.02				0.05	
Potassium	4.80					
Sodium	64.00			160.00		
Alkalinity		NS				
Calcium	91.00					
Hardness		NS				
Boron		NS				0.63
Specific Conductance (umho/cm)	611.00					

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

282

Table A.7: Characteristics of the Cross Trails Rubble Landfill of Maryland.

LANDFILL:	Cross Trails Rubble Landfill, Maryland.
OWNER/OPERATOR:	Brandywine Enterprises, Inc. 5800 Sheriff Road Fairmont Heights, Maryland 20743
LITERATURE SOURCE:	C&D Waste Landfills, Leachate Quality Data, Volume 2. Prepared by Gershman, Brickner & Bratton, Inc. for the National Association of Demolition Contractors.
WASTE TYPE:	Construction waste and demolition debris. Specific composition characteristics are unknown.
ACREAGE:	Unknown.
YEARS IN SERVICE:	Unknown.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Leachate collection system installed.
LEACHATE SAMPLE:	Leachate sampled from leachate collection system.
MISCELLANEOUS:	Maryland Department of the Environment proved the leachate data for this landfill. Although liner system is unknown, at least one liner is probable since a leachate collection system is installed. Amount of leachate produced per month varies between 1,000 and 3000 gallons.

Table A.8: Sampling for the Cross Trails Rubble Landfill of Maryland.

	1993 Sampling			Primary	Secondary	Guidance
	Result		Det Limit	MCL	MCL	Conc
Volatiles	ug/l	ND/NS		ug/l	ug/l	ug/l
Acetone		NS				700.00
2-Butanone		NS				4200.00
Carbon Disulfide		NS				700.00
Chloromethane		ND	0.50			2.70
1,1-Dichloroethane		NS				700.00
1,2-Dichloroethane		ND	0.50	3.00		
1,4-Dioxane		NS				5.00
Ethylbenzene		ND	0.50		700.00	
Methyl Ethyl Ketone (MEK)		NS				4200.00
4-Methyl-2-Pentanone		NS				
Methylene Chloride		ND	0.50	5.00		
Toluene		ND	0.50	1000.00		
1,1,1 Trichloroethane		NS		200.00		
Trichloroethylene		NS		3.00		
Trichlorofluoromethane		ND	0.50			2100.00
Xylenes (Total)		NS		10000.00		
Semi-Volatiles	ug/l	ND/NS		ug/l	ug/l	ug/l
Acenaphthene		NS				20.00
Acetophenone		NS				700.00
Benzene	0.80		0.50	1.00		
Benzoic Acid		NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS				
2,4-Dimethylphenol		NS				400.00
Di-n-Butyl phthalate		NS				700.00
Diethyl Phthalate		NS				5600.00
Fluoranthene		NS				280.00
Napthalene		NS				6.80
m&p-Creosol		NS				35.00
o-Creosol		NS				350.00
Phenathrene		NS				10.00
Phenol		NS				10.00
Pyrene		NS				210.00
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ug/l	ug/l
Alpha-BHC		NS				0.05
Endrin		NS		2.00		
Dieldrin		NS				0.10
Dimethoate		NS				5.00
Disulfoton		NS				0.50
2,4,5-T		NS				70.00
2,4-D		NS		70.00		
HxCDD		NS				
HxCDF		NS				
APRIL 1992 SAMPLING:						
Heavy Metals	ug/l	ND/NS		ug/l	ug/l	ug/l
Antimony		ND	300.00	50.00		
Arsenic	8.00		5.00	2000.00		
Barium	1000.00		NA	5.00		
Cadmium		ND	20.00	100.00		
Chromium		ND	60.00	1000.00		
Copper		ND	30.00	15.00		
Lead		ND	200.00	2.00		
Mercury		ND	0.50	100.00		
Nickel		ND	60.00	50.00		
Selenium		ND	5.00		100.00	
Silver		ND	5.00	2.00		
Thallium		ND	400.00			49.00
Vanadium		NS			5000.00	

1082

Dimethoate		NS				5.00
Disulfoton		NS				0.50
2,4,5-T		NS				70.00
2,4-D		NS		70.00		
HxCDD		NS				
HxCDF		NS				
APRIL 1992 SAMPLING:						
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		ND	300.00	50.00		
Arsenic	8.00		5.00	2000.00		
Barium	1000.00		NA	5.00		
Cadmium		ND	20.00	100.00		
Chromium		ND	60.00	1000.00		
Copper		ND	30.00	15.00		
Lead		ND	200.00	2.00		
Mercury		ND	0.50	100.00		
Nickel		ND	60.00	50.00		
Selenium		ND	5.00		100.00	
Silver		ND	5.00	2.00		
Thallium		ND	400.00			49.00
Vanadium		NS			5000.00	
Zinc	84.00		8.00			
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	11.00		1.00			
Chemical Oxygen Demand	180.00		10.00		250.00	
Chlorides	100.00		1.00	0.20		
Cyanide		NS				
Ammonia, Nitrogen	1.40		1.00			
Organic Nitrogen		NS		10.00		
Nitrate		ND		1.00		
Nitrite		ND			0.30	
Iron	46.00		1.00			
Oil and Grease		NS			6.5-8.5	
pH	6.46					
Phenols (Total)		NS				
Phosphorus	0.82		0.15			
Total Suspended Solids		NS			500.00	
Total Dissolved Solids	1606.00				250.00	
Sulfate	380.00		5.00			
Total Organic Carbon		NS				
TOC (Duplicate)		NS				
Total Organic Halogens		NS				
Magnesium	120.00		8.00		0.05	
Mangenese	2.20		0.04			
Potassium	42.00		3.00	160.00		
Sodium	100.00		4.00			
Alkalinity	1800.00		1.00			
Calcium	480.00		80.00			
Hardness	2114.00					0.63
Boron		NS				
Specific Conductance (umho/cm)	2240.00					

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL - Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations - Not Enforceable Standards

282

Table A.9: Characteristics of the D&M Site of Connecticut.

LANDFILL:	D&M Site, Connecticut.
OWNER/OPERATOR:	Unknown.
LITERATURE SOURCE:	Construction and Demolition Waste Landfills. Prepared by ICF Incorporated for the U.S. Environmental Protection Agency, Office of Solid Waste.
WASTE TYPE:	Demolition debris and landclearing debris.
ACREAGE:	Unknown.
YEARS IN SERVICE:	Unknown.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	Unknown.
MISCELLANEOUS:	None.

Table A.10: Sampling for the D and M Landfill of Connecticut.

	Sample 1 Result		Det Limit	Sample 2 Result		Det Limit	Primary MCL	Secondary MCL	Guidance Conc
Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acetone		NS			NS				700.00
2-Butanone		NS			NS				4200.00
Carbon Disulfide		NS			NS				700.00
Chloromethane		NS			NS				2.70
1,1-Dichloroethane		NS			NS				700.00
1,2-Dichloroethane		NS			NS		3.00		
1,4-Dioxane		NS			NS				5.00
Ethylbenzene		NS			NS			700.00	
Methyl Ethyl Ketone (MEK)		NS			NS				4200.00
4-Methyl-2-Pentanone		NS			NS				
Methylene Chloride		NS			NS		5.00		
Toluene		NS			NS		1000.00		
1,1,1 Trichloroethane		NS			NS		200.00		
Trichloroethylene		NS			NS		3.00		
Trichlorofluoromethane		NS			NS				2100.00
Xylenes (Total)		NS			NS		10000.00		
Semi-Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acenaphthene		NS			NS				20.00
Acetophenone		NS			NS				700.00
Benzene		NS			NS		1.00		
Benzoic Acid		NS			NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS			NS				
2,4-Dimethylphenol		NS			NS				400.00
Di-n-Butyl phthalate		NS			NS				700.00
Diethyl Phthalate		NS			NS				5600.00
Fluoranthene		NS			NS				280.00
Napthalene		NS			NS				6.80
m&p-Creosol		NS			NS				35.00
o-Creosol		NS			NS				350.00
Phenathrene		NS			NS				10.00
Phenol		NS			NS				10.00
Pyrene		NS			NS				210.00
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Alpha-BHC		NS			NS				0.05
Endrin		NS			NS		2.00		
Dieldrin		NS			NS				0.10
Dimethoate		NS			NS				5.00
Disulfoton		NS			NS				0.50
2,4,5-T		NS			NS				70.00
2,4-D		NS			NS		70.00		
HxCDD		NS			NS				
HxCDF		NS			NS				
Heavy Metals	ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Antimony		NS			NS		6.00		
Arsenic		NS			NS		50.00		
Barium		NS			NS		2000.00		
Cadmium		NS			NS		5.00		
Chromium		NS			NS		100.00		
Copper		NS			NS		1000.00		
Lead		NS			NS		15.00		
Mercury		NS			NS		2.00		
Nickel		NS			NS		100.00		
Selenium		NS			NS		50.00		
Silver		NS			NS			100.00	
Thallium		NS			NS		2.00		
Vanadium		NS			NS				49.00

182

HxCDF		NS			NS				
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		NS			NS		6.00		
Arsenic		NS			NS		50.00		
Barium		NS			NS		2000.00		
Cadmium		NS			NS		5.00		
Chromium		NS			NS		100.00		
Copper		NS			NS		1000.00		
Lead		NS			NS		15.00		
Mercury		NS			NS		2.00		
Nickel		NS			NS		100.00		
Selenium		NS			NS		50.00		
Silver		NS			NS			100.00	
Thallium		NS			NS		2.00		
Vanadium		NS			NS				49.00
Zinc		NS			NS			5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand		NS			NS				
Chemical Oxygen Demand		NS			NS				
Chlorides	17.00			38.00				250.00	
Cyanide		NS			NS		0.20		
Ammonia, Nitrogen		NS			NS				
Organic Nitrogen	1.80				NS				
Nitrate		NS			NS		10.00		
Nitrite		NS			NS		1.00		
Iron	0.30			2.00				0.30	
Oil and Grease		NS			NS				
pH	7.20			8.00				6.5-8.5	
Phenols (Total)		NS			NS				
Phosphorus		NS			NS				
Total Suspended Solids	26.00				NS				
Total Dissolved Solids	640.00			2900.00				500.00	
Sulfate		NS			NS			250.00	
Total Organic Carbon		NS			NS				
TOC (Duplicate)		NS			NS				
Total Organic Halogens		NS			NS				
Magnesium		NS			NS				
Mangenese		NS			NS			0.05	
Potassium		NS			NS				
Sodium		NS			NS		160.00		
Alkalinity	620.00				NS				
Calcium		NS			NS				
Hardness		NS			NS				
Boron		NS			NS				0.63
Specific Conductance (umho/cm)		NS			NS				

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.11: Characteristics of the Deep River Bulky Waste Landfill of Connecticut.

LANDFILL:	Deep River Bulky Waste Landfill, Connecticut.
OWNER/OPERATOR:	Unknown.
LITERATURE SOURCE:	Bulky Waste Leachate Characterization Survey Maurice Hamel, Connecticut Department of Environmental Protection Presented in C&D Waste Landfills, Leachate Quality Data, Volume 2. Prepared by Gershman, Brickner & Bratton, Inc. For the National Association of Demolition Contractors.
WASTE TYPE:	Demolition debris and landclearing debris. Includes scrap metal.
ACREAGE:	4 acres.
YEARS IN SERVICE:	Opened in 1976.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	Leachate sample taken from seep at base of fill at edge of wetland.
MISCELLANEOUS:	There is black manganese staining at the seep. Ammonia concentrations are consistently elevated suggesting siting or operational problems.

Table A.12: Sampling for the Deep River Bulky Waste Landfill of Connecticut.

	June-1988			August-1988			October-1988			December-1988			Primary	Secondary	Guidance
	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	MCL	MCL	Conc
Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acetone		NS			NS			NS			NS				700.00
2-Butanone		NS			NS			NS			NS				4200.00
Carbon Disulfide		NS			NS			NS			NS				700.00
Chloromethane		NS			NS			NS			NS				2.70
1,1-Dichloroethane		NS			NS			NS			NS				700.00
1,2-Dichloroethane		NS			NS			NS			NS		3.00		
1,4-Dioxane		NS			NS			NS			NS				5.00
Ethylbenzene		NS			NS			NS			NS			700.00	
Methyl Ethyl Ketone (MEK)		NS			NS			NS			NS				4200.00
4-Methyl-2-Pentanone		NS			NS			NS			NS				
Methylene Chloride		NS			NS			NS			NS		5.00		
Toluene		NS			NS			NS			NS		1000.00		
1,1,1-trichloroethane		NS			NS			NS			NS		200.00		
Trichloroethylene		NS			NS			NS			NS		3.00		
Trichlorofluoromethane		NS			NS			NS			NS				2100.00
Xylenes (Total)		NS			NS			NS			NS		10000.00		
Semi-Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acenaphthene		NS			NS			NS			NS				20.00
Acetophenone		NS			NS			NS			NS				700.00
Benzene		NS			NS			NS			NS		1.00		
Benzoic Acid		NS			NS			NS			NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS			NS			NS			NS				
2,4-Dimethylphenol		NS			NS			NS			NS				400.00
Di-n-Butyl phthalate		NS			NS			NS			NS				700.00
Diethyl Phthalate		NS			NS			NS			NS				5600.00
Fluoranthene		NS			NS			NS			NS				280.00
Napthalene		NS			NS			NS			NS				6.80
m&p-Creosol		NS			NS			NS			NS				35.00
o-Creosol		NS			NS			NS			NS				350.00
Phenathrene		NS			NS			NS			NS				10.00
Phenol		NS			NS			NS			NS				10.00
Pyrene		NS			NS			NS			NS				210.00
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Alpha-BHC		NS			NS			NS			NS				0.05
Endrin		NS			NS			NS			NS		2.00		
Dieldrin		NS			NS			NS			NS				0.10
Dimethoate		NS			NS			NS			NS				5.00
Disulfoton		NS			NS			NS			NS				0.50
2,4,5-T		NS			NS			NS			NS				70.00
2,4-D		NS			NS			NS			NS		70.00		
HxCDD		NS			NS			NS			NS				
HxCDF		NS			NS			NS			NS				
Heavy Metals	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Antimony		NS			NS			NS			NS		6.00		
Arsenic		ND			ND			ND			ND		50.00		
Barium	160.00			300.00			200.00			200.00			2000.00		
Cadmium		ND			ND			ND		10.00			5.00		
Chromium		ND			ND			ND			ND		100.00		
Copper	30.00			20.00			110.00			40.00			1000.00		
Lead	50.00			50.00			50.00			70.00			15.00		
Mercury		ND			ND			ND			ND		2.00		
Nickel		NS			NS			NS			NS		100.00		
Selenium		ND			ND			ND			ND		50.00		
Silver	10.00				ND			ND			ND			100.00	
Thallium		NS			NS			NS			NS		2.00		
Vanadium		NS			NS			NS			NS				49.00
Zinc		NS			NS			NS			NS			5000.00	

182.

HxCDF		NS			NS			NS			NS				
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		NS			NS			NS			NS		6.00		
Arsenic		ND			ND			ND			ND		50.00		
Barium	160.00			300.00			200.00			200.00			2000.00		
Cadmium		ND			ND			ND		10.00			5.00		
Chromium		ND			ND			ND			ND		100.00		
Copper	30.00			20.00			110.00			40.00			1000.00		
Lead	50.00			50.00			50.00			70.00			15.00		
Mercury		ND			ND			ND			ND		2.00		
Nickel		NS			NS			NS			NS		100.00		
Selenium		ND			ND			ND			ND		50.00		
Silver	10.00				ND			ND			ND			100.00	
Thallium		NS			NS			NS			NS		2.00		
Vanadium		NS			NS			NS			NS				49.00
Zinc		NS			NS			NS			NS			5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	45.00				NS		11.00			24.00					
Chemical Oxygen Demand	45.00			50.00			30.00			58.00					
Chlorides	23.00			120.00			100.00			120.00				250.00	
Cyanide		ND			ND			ND		0.34			0.20		
Ammonia, Nitrogen	3.00			3.00			4.80			4.20					
Organic Nitrogen	2.00			0.70				ND		0.80					
Nitrate		ND			ND			ND			ND		10.00		
Nitrite		ND		0.00				ND		0.00			1.00		
Iron	36.00			88.00			33.00			29.00				0.30	
Oil and Grease		NS			NS			NS			NS				
pH	6.70			6.70			6.60			6.40				6.5-8.5	
Phenols (Total)		NS			NS			NS			NS				
Phosphorus		NS			NS			NS			NS				
Total Suspended Solids	150.00			150.00			110.00			100.00					
Total Dissolved Solids	480.00			510.00			500.00			550.00				500.00	
Sulfate	95.00			21.00				ND		55.00				250.00	
Total Organic Carbon		NS			NS			NS			NS				
TOC (Duplicate)		NS			NS			NS			NS				
Total Organic Halogens		NS			NS			NS			NS				
Magnesium		NS			NS			NS			NS				
Mangenese	2.20			6.30			3.50			2.60				0.05	
Potassium		NS			NS			NS			NS				
Sodium	20.00			82.00				NS		24.00			160.00		
Alkalinity	360.00			300.00				ND		170.00					
Calcium		NS			NS			NS			NS				
Hardness	400.00			420.00				NS		250.00					
Boron															0.63
Specific Conductance (umho/cm)	770.00			780.00				NS		840.00					

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.13: Characteristics of the Des Moines Landfill #4 of Iowa.

LANDFILL:	Des Moines Landfill #4 SLF, Iowa.
OWNER/OPERATOR:	Unknown.
LITERATURE SOURCE:	State of Iowa, Department of Natural Resources Presented in C&D Waste Landfills, Leachate Quality Data, Volume 1. Prepared by Gershman, Brickner & Bratton, Inc. For the National Association of Demolition Contractors.
WASTE TYPE:	Demolition debris and landclearing debris.
ACREAGE:	Unknown.
YEARS IN SERVICE:	Unknown.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	Leachate sample taken from leachate wells.
MISCELLANEOUS:	None.

Table A.14: Sampling for the Des Moines Landfill #4 of Iowa.

	6/25/93 Result		Det Limit	Primary MCL	Secondary MCL	Guidance Conc
Volatiles	ug/l	ND/NS		ug/l	ug/l	ug/l
Acetone		NS				700.00
2-Butanone		NS				4200.00
Carbon Disulfide		NS				700.00
Chloromethane		ND	10.00			2.70
1,1-Dichloroethane	6.20		1.00			700.00
1,2-Dichloroethane		ND	0.40	3.00		
1,4-Dioxane		NS				5.00
Ethylbenzene	2.60		1.00		700.00	
Methyl Ethyl Ketone (MEK)		NS				4200.00
4-Methyl-2-Pentanone		NS				
Methylene Chloride	24.40		5.00	5.00		
Toluene	30.30		1.00	1000.00		
1,1,1 Trichloroethane		ND	1.00	200.00		
Trichloroethylene	3.20		1.00	3.00		
Trichlorofluoromethane		NS				2100.00
Xylenes (Total)	12.30		1.00	10000.00		
Semi-Volatiles	ug/l	ND/NS		ug/l	ug/l	ug/l
Acenaphthene		NS				20.00
Acetophenone		NS				700.00
Benzene	2.70		1.00	1.00		
Benzoic Acid		ND	50.00			28000.00
Bis(2-Ethylhexyl)phthalate		ND	10.00			
2,4-Dimethylphenol		ND	10.00			400.00
Di-n-Butyl phthalate		ND	10.00			700.00
Diethyl Phthalate		ND	10.00			5600.00
Fluoranthene		ND	10.00			280.00
Napthalene		ND	10.00			6.80
m&p-Creosol		ND	10.00			35.00
o-Creosol		ND	10.00			350.00
Phenathrene		ND	10.00			10.00
Phenol		NS				10.00
Pyrene		ND	10.00			210.00
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ug/l	ug/l
Alpha-BHC		ND	0.05			0.05
Endrin	0.07			2.00		
Dieldrin		ND	0.05			0.10
Dimethoate		NS				5.00
Disulfoton		NS				0.50
2,4,5-T		NS				70.00
2,4-D		NS		70.00		
HxCDD		NS				
HxCDF		NS				
Heavy Metals	ug/l	ND/NS		ug/l	ug/l	ug/l
Antimony		NS		6.00		
Arsenic	18.00		5.00	50.00		
Barium		NS		2000.00		
Cadmium		ND	1.00	5.00		
Chromium		ND	30.00	100.00		
Copper	72.00		30.00	1000.00		
Lead	13.00		5.00	15.00		
Mercury	0.50		0.50	2.00		
Nickel		ND	50.00	100.00		
Selenium		ND	10.00	50.00		
Silver		NS			100.00	
Thallium		NS		2.00		
Vanadium		NS				49.00
Zinc	403.00		30.00		5000.00	

182

2,4,5-T		NS				70.00
2,4-D		NS		70.00		
HxCDD		NS				
HxCDF		NS				
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		NS		6.00		
Arsenic	18.00		5.00	50.00		
Barium		NS		2000.00		
Cadmium		ND	1.00	5.00		
Chromium		ND	30.00	100.00		
Copper	72.00		30.00	1000.00		
Lead	13.00		5.00	15.00		
Mercury	0.50		0.50	2.00		
Nickel		ND	50.00	100.00		
Selenium		ND	10.00	50.00		
Silver		NS			100.00	
Thallium		NS		2.00		
Vanadium		NS				49.00
Zinc	403.00		30.00		5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	170.00		3.00			
Chemical Oxygen Demand	130.00		3.00			
Chlorides	153.00		10.00		250.00	
Cyanide		ND	0.02	0.20		
Ammonia, Nitrogen	18.40		1.00			
Organic Nitrogen	5.10		10.00			
Nitrate		ND	1.00	10.00		
Nitrite		NS		1.00		
Iron	49.10		0.03		0.30	
Oil and Grease		NS				
pH		NS			6.5-8.5	
Phenols (Total)		NS				
Phosphorus	1.30		1.00			
Total Suspended Solids	6100.00		1.00			
Total Dissolved Solids		NS			500.00	
Sulfate		NS			250.00	
Total Organic Carbon		NS				
TOC (Duplicate)		NS				
Total Organic Halogens		NS				
Magnesium		NS				
Mangenese		NS			0.05	
Potassium	110.00		1.00			
Sodium		NS		160.00		
Alkalinity		NS				
Calcium		NS				
Hardness		NS				
Boron		NS				0.63
Specific Conductance (umho/cm)		NS				

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.15: Characteristics of the Des Moines Landfill #5 of Iowa.

LANDFILL:	Des Moines Landfill #5 SLF, Iowa.
OWNER/OPERATOR:	Unknown.
LITERATURE SOURCE:	State of Iowa, Department of Natural Resources Presented in C&D Waste Landfills, Leachate Quality Data, Volume 1. Prepared by Gershman, Brickner & Bratton, Inc. For the National Association of Demolition Contractors.
WASTE TYPE:	Demolition debris and landclearing debris.
ACREAGE:	Unknown.
YEARS IN SERVICE:	Unknown.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	Leachate sample taken from leachate wells.
MISCELLANEOUS:	None.

Table A.16: Sampling for the Des Moines Landfill #5 of Iowa.

	6/25/93 Result		Det Limit	Primary MCL	Secondary MCL	Guidance Conc
Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acetone		NS				700.00
2-Butanone		NS				4200.00
Carbon Disulfide		NS				700.00
Chloromethane		ND	10.00			2.70
1,1-Dichloroethane	5.60		1.00			700.00
1,2-Dichloroethane		ND	0.40	3.00		
1,4-Dioxane		NS				5.00
Ethylbenzene	1.90		1.00		700.00	
Methyl Ethyl Ketone (MEK)		NS				4200.00
4-Methyl-2-Pentanone		NS				
Methylene Chloride		ND	5.00	5.00		
Toluene	2.60		1.00	1000.00		
1,1,1 Trichloroethane		ND	1.00	200.00		
Trichloroethylene		ND	1.00	3.00		
Trichlorofluoromethane		NS				2100.00
Xylenes (Total)	5.60		1.00	10000.00		
Semi-Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acenaphthene		NS				20.00
Acetophenone		NS				700.00
Benzene		ND	1.00	1.00		
Benzoic Acid		ND	50.00			28000.00
Bis(2-Ethylhexyl)phthalate		ND	10.00			
2,4-Dimethylphenol		ND	10.00			400.00
Di-n-Butyl phthalate		ND	10.00			700.00
Diethyl Phthalate	16.00		10.00			5600.00
Fluoranthene		ND	10.00			280.00
Napthalene		ND	10.00			6.80
m&p-Creosol		ND	10.00			35.00
o-Creosol		ND	10.00			350.00
Phenathrene		ND	10.00			10.00
Phenol		NS				10.00
Pyrene		ND	10.00			210.00
Herbicides/Pesticides	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Alpha-BHC		ND	0.05			0.05
Endrin		ND	0.05	2.00		
Dieldrin		ND	0.05			0.10
Dimethoate		NS				5.00
Disulfoton		NS				0.50
2,4,5-T		NS				70.00
2,4-D		NS		70.00		
HxCDD		NS				
HxCDF		NS				
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		NS		6.00		
Arsenic	37.00		5.00	50.00		
Barium		NS		2000.00		
Cadmium		ND	1.00	5.00		
Chromium		ND	30.00	100.00		
Copper	57.00		30.00	1000.00		
Lead	40.00		5.00	15.00		
Mercury	0.50		0.50	2.00		
Nickel	99.00		50.00	100.00		
Selenium		ND	10.00	50.00		
Silver		NS			100.00	
Thallium		NS		2.00		
Vanadium		NS				49.00
Zinc	135.00		30.00		5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**

182

Antimony		NS		6.00		
Arsenic	37.00		5.00	50.00		
Barium		NS		2000.00		
Cadmium		ND	1.00	5.00		
Chromium		ND	30.00	100.00		
Copper	57.00		30.00	1000.00		
Lead	40.00		5.00	15.00		
Mercury	0.50		0.50	2.00		
Nickel	99.00		50.00	100.00		
Selenium		ND	10.00	50.00		
Silver		NS			100.00	
Thallium		NS		2.00		
Vanadium		NS				49.00
Zinc	135.00		30.00		5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	15.00		3.00			
Chemical Oxygen Demand	14.00		3.00			
Chlorides	39.80		10.00		250.00	
Cyanide		ND	0.02	0.20		
Ammonia, Nitrogen		ND	1.00			
Organic Nitrogen	17.90		10.00			
Nitrate		ND	1.00	10.00		
Nitrite		NS		1.00		
Iron	48.50		0.03		0.30	
Oil and Grease		NS				
pH		NS			6.5-8.5	
Phenols (Total)		NS				
Phosphorus		ND	1.00			
Total Suspended Solids		140.00	1.00			
Total Dissolved Solids		NS			500.00	
Sulfate		NS			250.00	
Total Organic Carbon		NS				
TOC (Duplicate)		NS				
Total Organic Halogens		NS				
Magnesium		NS				
Mangenese		NS			0.05	
Potassium	3.02		1.00			
Sodium		NS		160.00		
Alkalinity		NS				
Calcium		NS				
Hardness		NS				
Boron		NS				0.63
Specific Conductance (umho/cm)		NS				

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.17: Characteristics of the Glastonbury Bulky Waste Landfill of Connecticut.

LANDFILL:	Glastonbury Bulky Waste Landfill, Connecticut.
OWNER/OPERATOR:	Unknown.
LITERATURE SOURCE:	Bulky Waste Leachate Characterization Survey Maurice Hamel, Connecticut Department of Environmental Protection Presented in C&D Waste Landfills, Leachate Quality Data, Volume 2. Prepared by Gershman, Brickner & Bratton, Inc. For the National Association of Demolition Contractors.
WASTE TYPE:	Demolition debris and landclearing debris.
ACREAGE:	15 acres.
YEARS IN SERVICE:	Opened in 1977.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	Leachate sample taken from monitor well B2, approximately 10 feet from the toe of the landfill.
MISCELLANEOUS:	None.

Table A.18: Sampling for the Glastonbury Bulky Waste Landfill of Connecticut.

	July-1988			August-1988			October-1988			December-1988			Primary	Secondary	Guidance
	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	MCL	MCL	Conc
Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acetone		NS			NS			NS			NS				700.00
2-Butanone		NS			NS			NS			NS				4200.00
Carbon Disulfide		NS			NS			NS			NS				700.00
Chloromethane		NS			NS			NS			NS				2.70
1,1-Dichloroethane		NS			NS			NS			NS				700.00
1,2-Dichloroethane		NS			NS			NS			NS		3.00		
1,4-Dioxane		NS			NS			NS			NS				5.00
Ethylbenzene		NS			NS			NS			NS			700.00	
Methyl Ethyl Ketone (MEK)		NS			NS			NS			NS				4200.00
4-Methyl-2-Pentanone		NS			NS			NS			NS				
Methylene Chloride		NS			NS			NS			NS		5.00		
Toluene		NS			NS			NS			NS		1000.00		
1,1,1-trichloroethane		NS			NS			NS			NS		200.00		
Trichloroethylene		NS			NS			NS			NS		3.00		
Trichlorofluoromethane		NS			NS			NS			NS				2100.00
Xylenes (Total)		NS			NS			NS			NS		10000.00		
Semi-Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acenaphthene		NS			NS			NS			NS				20.00
Acetophenone		NS			NS			NS			NS				700.00
Benzene		NS			NS			NS			NS		1.00		
Benzoic Acid		NS			NS			NS			NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS			NS			NS			NS				
2,4-Dimethylphenol		NS			NS			NS			NS				400.00
Di-n-Butyl phthalate		NS			NS			NS			NS				700.00
Diethyl Phthalate		NS			NS			NS			NS				5600.00
Fluoranthene		NS			NS			NS			NS				280.00
Napthalene		NS			NS			NS			NS				6.80
m&p-Creosol		NS			NS			NS			NS				35.00
o-Creosol		NS			NS			NS			NS				350.00
Phenathrene		NS			NS			NS			NS				10.00
Phenol		NS			NS			NS			NS				10.00
Pyrene		NS			NS			NS			NS				210.00
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Alpha-BHC		NS			NS			NS			NS				0.05
Endrin		NS			NS			NS			NS		2.00		
Dieldrin		NS			NS			NS			NS				0.10
Dimethoate		NS			NS			NS			NS				5.00
Disulfoton		NS			NS			NS			NS				0.50
2,4,5-T		NS			NS			NS			NS				70.00
2,4-D		NS			NS			NS			NS		70.00		
HxCDD		NS			NS			NS			NS				
HxCDF		NS			NS			NS			NS				
Heavy Metals	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Antimony		NS			NS			NS			NS		6.00		
Arsenic		ND			ND		20.00				ND		50.00		
Barium	400.00			300.00			800.00			100.00			2000.00		
Cadmium	20.00				ND		10.00			10.00			5.00		
Chromium	10.00				ND		40.00				ND		100.00		
Copper	50.00			30.00			620.00			50.00			1000.00		
Lead	60.00			40.00			40.00			40.00			15.00		
Mercury		ND			ND			ND			ND		2.00		
Nickel	50.00				NS			NS			NS		100.00		
Selenium		ND			ND			ND			ND		50.00		
Silver		ND			ND			ND			ND			100.00	
Thallium		NS			NS			NS			NS		2.00		
Vanadium		NS			NS			NS			NS				49.00
Zinc	70.00				NS			NS			NS			5000.00	

1082

2,4-D		NS			NS			NS			NS		[illegible]		
HxCDD		NS			NS			NS			NS				
HxCDF		NS			NS			NS			NS				
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		NS			NS			NS			NS		6.00		
Arsenic		ND			ND		20.00				ND		50.00		
Barium	400.00			300.00			800.00			100.00			2000.00		
Cadmium	20.00				ND		10.00			10.00			5.00		
Chromium	10.00				ND		40.00				ND		100.00		
Copper	50.00			30.00			620.00			50.00			1000.00		
Lead	60.00			40.00			40.00			40.00			15.00		
Mercury		ND			ND			ND			ND		2.00		
Nickel	50.00				NS			NS			NS		100.00		
Selenium		ND			ND			ND			ND		50.00		
Silver		ND			ND			ND			ND			100.00	
Thallium		NS			NS			NS			NS		2.00		
Vanadium		NS			NS			NS			NS				49.00
Zinc	70.00				NS			NS			NS			5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand*	70.00			20.00			24.00			16.00					
Chemical Oxygen Demand	30.00			13.00				ND		15.00					
Chlorides	21.00			17.00			20.00			18.00				250.00	
Cyanide		ND			ND			ND		0.03			0.20		
Ammonia, Nitrogen	0.10				ND			ND		0.04					
Organic Nitrogen	1.10			0.90			0.32			0.32					
Nitrate	4.60			5.30			3.00			5.10			10.00		
Nitrite	0.01			0.02			0.02			0.02			1.00		
Iron	0.20			0.40			33.00			14.00				0.30	
Oil and Grease		NS			NS			NS			NS				
pH	7.30			6.90			7.00			6.70				6.5-8.5	
Phenols (Total)		NS			NS			NS			NS				
Phosphorus		NS			NS			NS			NS				
Total Suspended Solids	5000.00			3600.00			1900.00			2400.00					
Total Dissolved Solids	700.00			700.00			630.00			720.00				500.00	
Sulfate	42.00			36.00			44.00			58.00				250.00	
Total Organic Carbon		NS			NS			NS			NS				
TOC (Duplicate)		NS			NS			NS			NS				
Total Organic Halogens		NS			NS			NS			NS				
Magnesium		NS			NS			NS			NS				
Mangenese	0.07			0.08			2.10			3.10				0.05	
Potassium		NS			NS			NS			NS				
Sodium	61.00			78.00			54.00			33.00			160.00		
Alkalinity	500.00			440.00			550.00			260.00					
Calcium		NS			NS			NS			NS				
Hardness	440.00			720.00			500.00			250.00					
Boron		NS			NS			NS			NS				0.63
Specific Conductance (umho/cm)	970.00			220.00			1000.00			980.00					

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

202

Table A.19: Characteristics of the Groton Bulky Waste Landfill of Connecticut.

LANDFILL:	Groton Bulky Waste Landfill, Connecticut.
OWNER/OPERATOR:	Unknown.
LITERATURE SOURCE:	Bulky Waste Leachate Characterization Survey Maurice Hamel, Connecticut Department of Environmental Protection Presented in C&D Waste Landfills, Leachate Quality Data, Volume 2. Prepared by Gershman, Brickner & Bratton, Inc. For the National Association of Demolition Contractors.
WASTE TYPE:	Demolition debris and landclearing debris.
ACREAGE:	33 acres.
YEARS IN SERVICE:	Opened in 1978.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	Leachate sample taken from seep at the toe of landfill.
MISCELLANEOUS:	None.

Table A.20: Sampling for the Groton Wells Bulky Waste Landfill of Connecticut.

	June-1988			February-1989			Primary	Secondary	Guidance
	Result		Det Limit	Result		Det Limit	MCL	MCL	Conc
Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acetone		NS			NS				700.00
2-Butanone		NS			NS				4200.00
Carbon Disulfide		NS			NS				700.00
Chloromethane		NS			NS				2.70
1,1-Dichloroethane		NS			NS				700.00
1,2-Dichloroethane		NS			NS		3.00		
1,4-Dioxane		NS			NS				5.00
Ethylbenzene		NS			NS			700.00	
Methyl Ethyl Ketone (MEK)		NS			NS				4200.00
4-Methyl-2-Pentanone		NS			NS				
Methylene Chloride		NS			NS		5.00		
Toluene		NS			NS		1000.00		
1,1,1-trichloroethane		NS			NS		200.00		
Trichloroethylene		NS			NS		3.00		
Trichlorofluoromethane		NS			NS				2100.00
Xylenes (Total)		NS			NS		10000.00		
Semi-Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acenaphthene		NS			NS				20.00
Acetophenone		NS			NS				700.00
Benzene		NS			NS		1.00		
Benzoic Acid		NS			NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS			NS				
2,4-Dimethylphenol		NS			NS				400.00
Di-n-Butyl phthalate		NS			NS				700.00
Diethyl Phthalate		NS			NS				5600.00
Fluoranthene		NS			NS				280.00
Napthalene		NS			NS				6.80
m&p-Creosol		NS			NS				35.00
o-Creosol		NS			NS				350.00
Phenathrene		NS			NS				10.00
Phenol		NS			NS				10.00
Pyrene		NS			NS				210.00
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Alpha-BHC		NS			NS				0.05
Endrin		NS			NS		2.00		
Dieldrin		NS			NS				0.10
Dimethoate		NS			NS				5.00
Disulfoton		NS			NS				0.50
2,4,5-T		NS			NS				70.00
2,4-D		NS			NS		70.00		
HxCDD		NS			NS				
HxCDF		NS			NS				
Heavy Metals	ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Antimony		NS			NS		6.00		
Arsenic		ND			ND		50.00		
Barium	300.00			100.00			2000.00		
Cadmium		ND		10.00			5.00		
Chromium		ND			ND		100.00		
Copper	20.00			40.00			1000.00		
Lead	40.00			70.00			15.00		
Mercury		ND			ND		2.00		
Nickel		NS			ND		100.00		
Selenium		ND			ND		50.00		
Silver		ND			ND			100.00	
Thallium		NS			NS		2.00		

Copper	20.00			40.00			1000.00		
Lead	40.00			70.00			15.00		
Mercury		ND			ND		2.00		
Nickel		NS			ND		100.00		
Selenium		ND			ND		50.00		
Silver		ND			ND			100.00	
Thallium		NS			NS		2.00		
Vanadium		NS			NS				49.00
Zinc		NS			NS			5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	28.00				NS				
Chemical Oxygen Demand	68.00			35.00					
Chlorides	15.00			8.00				250.00	
Cyanide		ND		0.09			0.20		
Ammonia, Nitrogen	0.50			0.30					
Organic Nitrogen	0.07			0.50					
Nitrate		ND		0.10			10.00		
Nitrite		ND		0.01			1.00		
Iron	2.50				NS			0.30	
Oil and Grease		NS			NS				
pH	6.70			6.20				6.5-8.5	
Phenols (Total)		NS			NS				
Phosphorus		NS			NS				
Total Suspended Solids	270.00			53.00					
Total Dissolved Solids	400.00			440.00				500.00	
Sulfate	40.00			200.00				250.00	
Total Organic Carbon		NS			NS				
TOC (Duplicate)		NS			NS				
Total Organic Halogens		NS			NS				
Magnesium		NS			NS				
Mangenese	5.80			1.10				0.05	
Potassium		NS			NS				
Sodium	17.00			11.00			160.00		
Alkalinity	280.00			58.00					
Calcium		NS			NS				
Hardness	280.00			300.00					
Boron		NS			NS				0.63
Specific Conductance (umho/cm)	610.00			530.00					

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.21: Characteristics of the Guilford Bulky Waste Landfill of Connecticut.

LANDFILL:	Guilford Bulky Waste Landfill, Connecticut.
OWNER/OPERATOR:	Unknown.
LITERATURE SOURCE:	Bulky Waste Leachate Characterization Survey Maurice Hamel, Connecticut Department of Environmental Protection Presented in C&D Waste Landfills, Leachate Quality Data, Volume 2. Prepared by Gershman, Brickner & Bratton, Inc. For the National Association of Demolition Contractors.
WASTE TYPE:	Demolition debris and landclearing debris and wood.
ACREAGE:	5 acres.
YEARS IN SERVICE:	Opened in 1973.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	Leachate sample taken from seep 100 feet southeast of culvert at a stone wall.
MISCELLANEOUS:	Runoff may sometimes dilute samples.

Table A.22: Sampling for the Guilford Bulky Waste Landfill of Connecticut.

	June-1988			October-1988			Primary	Secondary	Guidance
	Result		Det Limit	Result		Det Limit	MCL	MCL	Conc
Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acetone		NS			NS				700.00
2-Butanone		NS			NS				4200.00
Carbon Disulfide		NS			NS				700.00
Chloromethane		NS			NS				2.70
1,1-Dichloroethane		NS			NS				700.00
1,2-Dichloroethane		NS			NS		3.00		
1,4-Dioxane		NS			NS				5.00
Ethylbenzene		NS			NS			700.00	
Methyl Ethyl Ketone (MEK)		NS			NS				4200.00
4-Methyl-2-Pentanone		NS			NS				
Methylene Chloride		NS			NS		5.00		
Toluene		NS			NS		1000.00		
1,1,1-trichloroethane		NS			NS		200.00		
Trichloroethylene		NS			NS		3.00		
Trichlorofluoromethane		NS			NS				2100.00
Xylenes (Total)		NS			NS		10000.00		
Semi-Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acenaphthene		NS			NS				20.00
Acetophenone		NS			NS				700.00
Benzene		NS			NS		1.00		
Benzoic Acid		NS			NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS			NS				
2,4-Dimethylphenol		NS			NS				400.00
Di-n-Butyl phthalate		NS			NS				700.00
Diethyl Phthalate		NS			NS				5600.00
Fluoranthene		NS			NS				280.00
Napthalene		NS			NS				6.80
m&p-Creosol		NS			NS				35.00
o-Creosol		NS			NS				350.00
Phenathrene		NS			NS				10.00
Phenol		NS			NS				10.00
Pyrene		NS			NS				210.00
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Alpha-BHC		NS			NS				0.05
Endrin		NS			NS		2.00		
Dieldrin		NS			NS				0.10
Dimethoate		NS			NS				5.00
Disulfoton		NS			NS				0.50
2,4,5-T		NS			NS				70.00
2,4-D		NS			NS		70.00		
HxCDD		NS			NS				
HxCDF		NS			NS				
Heavy Metals	ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Antimony		NS			NS		6.00		
Arsenic		ND			ND		50.00		
Barium	60.00			100.00			2000.00		
Cadmium	10.00				ND		5.00		
Chromium		ND			ND		100.00		
Copper	50.00			30.00			1000.00		
Lead	40.00			40.00			15.00		
Mercury		ND			ND		2.00		
Nickel	50.00				NS		100.00		
Selenium		ND			ND		50.00		
Silver		ND			ND			100.00	
Thallium		NS			NS		2.00		
Vanadium		NS			NS				49.00
Zinc	70.00				NS			5000.00	
Conventional Parameters	mg/l	ND/NS		mg/l	ND/NS		mg/l	mg/l	mg/l
Biological Oxygen Demand	40.00			5.70					

Mercury		ND			ND		2.00		
Nickel	50.00				NS		100.00		
Selenium		ND			ND		50.00		
Silver		ND			ND			100.00	
Thallium		NS			NS		2.00		
Vanadium		NS			NS				49.00
Zinc	70.00				NS			5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	40.00			5.70					
Chemical Oxygen Demand	350.00			120.00					
Chlorides	45.00			60.00				250.00	
Cyanide		ND			ND		0.20		
Ammonia, Nitrogen	1.40			0.08					
Organic Nitrogen	2.20			1.80					
Nitrate	0.80			0.40			10.00		
Nitrite	0.05			0.00			1.00		
Iron	7.80			6.60				0.30	
Oil and Grease		NS			NS				
pH	6.90			7.00				6.5-8.5	
Phenols (Total)		NS			NS				
Phosphorus		NS			NS				
Total Suspended Solids	440.00			78.00					
Total Dissolved Solids	440.00			460.00				500.00	
Sulfate	64.00			97.00				250.00	
Total Organic Carbon		NS			NS				
TOC (Duplicate)		NS			NS				
Total Organic Halogens		NS			NS				
Magnesium		NS			NS				
Mangenese	4.10			2.80				0.05	
Potassium		NS			NS				
Sodium	34.00			32.00			160.00		
Alkalinity	190.00				NS				
Calcium		NS			NS				
Hardness	330.00			280.00					
Boron		NS			NS				0.63
Specific Conductance (umho/cm)	670.00			540.00					

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.23: Characteristics of the Kentucky Site.

LANDFILL:	Kentucky Site
OWNER/OPERATOR:	Waste Management of North America, Inc. 3003 Butterfield Road Oak Brook, IL 60521
LITERATURE SOURCE:	Construction and Demolition Landfill Leachate Characterization Study Prepared by Rust Environments & Infrastructure for WMX Technologies, Inc.
WASTE TYPE:	Construction waste and demolition debris. Includes brick, concrete, wood, plaster, plumbing fixtures, soil, rock, sawdust, metals, furniture, insulation, roofing materials. Yard waste, tires, and paper are not accepted.
ACREAGE:	13.5 acres.
YEARS IN SERVICE:	Opened in August 1985 and closed in November 1991.
LINER SYSTEM:	None.
LEACHATE SYSTEM:	None.
LEACHATE SAMPLE:	Leachate sample obtained by digging down 20 feet into the landfill until liquid was found.
MISCELLANEOUS:	None.

Table A.24: Sampling for the Kentucky Site.

	1991 Sampling Result		Det Limit	1992 Sampling Result		Det Limit	Primary MCL	Secondary MCL	Guidance Conc
Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acetone		ND	100.00		NS				700.00
2-Butanone		ND			NS				4200.00
Carbon Disulfide	15.00		5.00		NS				700.00
Chloromethane	24.00		10.00		NS				2.70
1,1-Dichloroethane		ND	5.00		NS				700.00
1,2-Dichloroethane	19.00		5.00		NS		3.00		
1,4-Dioxane		ND	10.00		NS				5.00
Ethylbenzene		ND	5.00		NS			700.00	
Methyl Ethyl Ketone (MEK)		ND	100.00		NS				4200.00
4-Methyl-2-Pentanone		ND	50.00		NS				
Methylene Chloride		ND	5.00		NS		5.00		
Toluene		ND	5.00		NS		1000.00		
1,1,1 Trichloroethane		NS			NS		200.00		
Trichloroethylene		ND	5.00		NS		3.00		
Trichlorofluoromethane		ND	10.00		NS				2100.00
Xylenes (Total)		ND	5.00		NS		10000.00		
Semi-Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acenaphthene		ND	49.00		ND	100.00			20.00
Acetophenone		ND	100.00		ND	100.00			700.00
Benzene		ND			NS		1.00		
Benzoic Acid		ND			NS				28000.00
Bis(2-Ethylhexyl)phthalate		ND	100.00		ND	500.00			
2,4-Dimethylphenol		ND	100.00		ND	100.00			400.00
Di-n-Butyl phthalate		ND	100.00		ND	100.00			700.00
Diethyl Phthalate		ND	100.00		ND	100.00			5600.00
Fluoranthene		ND	100.00	180.00		100.00			280.00
Napthalene		ND	100.00	130.00		100.00			6.80
m&p-Creosol		ND	100.00		ND	100.00			35.00
o-Creosol		ND	100.00		ND	100.00			350.00
Phenathrene		ND	100.00	300.00		100.00			10.00
Phenol		ND	100.00		ND	100.00			10.00
Pyrene		ND	100.00	190.00		100.00			210.00
Herbicides/Pesticides	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Alpha-BHC		ND	0.01		ND	0.10			0.05
Endrin		ND	0.01		ND	0.10	2.00		
Dieldrin		ND	0.01	0.20		0.10			0.10
Dimethoate		ND	1.90		ND	100.00			5.00
Disulfoton		ND	1.00		ND	100.00			0.50
2,4,5-T		ND	0.19		ND	1.00			70.00
2,4-D		ND	1.20		ND	1.00	70.00		
HxCDD		ND	2.30		ND	320.00			
HxCDF		ND	1.80		ND	210.00			
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		ND	7.00		ND	100.00	6.00		
Arsenic	12.00		4.00	41.30		10.00	50.00		
Barium	340.00		10.00	643.00		200.00	2000.00		
Cadmium		ND	5.00		ND	5.00	5.00		
Chromium		ND	10.00	36.60		10.00	100.00		
Copper		ND	20.00	155.00		25.00	1000.00		
Lead	220.00		15.00	1470.00		250.00	15.00		
Mercury		ND	0.20		ND	0.20	2.00		
Nickel	23.00		20.00	46.90		40.00	100.00		
Selenium		ND	5.00		ND	5.00	50.00		
Silver		NS			NS			100.00	
Thallium		ND	5.00		ND	10.00	2.00		
Vanadium		ND	20.00		ND	50.00			49.00
Zinc	810.00		20.00	2320.00		20.00		5000.00	

Chromium		ND	10.00	36.60		10.00	100.00		
Copper		ND	20.00	155.00		25.00	1000.00		
Lead	220.00		15.00	1470.00		250.00	15.00		
Mercury		ND	0.20		ND	0.20	2.00		
Nickel	23.00		20.00	46.90		40.00	100.00		
Selenium		ND	5.00		ND	5.00	50.00		
Silver		NS			NS			100.00	
Thallium		ND	5.00		ND	10.00	2.00		
Vanadium		ND	20.00		ND	50.00			49.00
Zinc	810.00		20.00	2320.00		20.00		5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	14.00		1.00		NS				
Chemical Oxygen Demand	180.00		60.00	199.00		10.00			
Chlorides	180.00		2.60	44.40		0.50		250.00	
Cyanide	0.01		0.01		ND	0.02	0.20		
Ammonia, Nitrogen	44.00		0.52	7.51		0.10			
Organic Nitrogen		NS			NS				
Nitrate		NS			NS		10.00		
Nitrite		NS			NS		1.00		
Iron	26.00		.04	48.60		0.10		0.30	
Oil and Grease	1.00		0.26	18.20		1.00			
pH	6.80			6.83				6.5-8.5	
Phenols (Total)		ND	0.01	0.01		0.01			
Phosphorus	1.00		0.06	0.86		0.20			
Total Suspended Solids	390.00		10.00	934.00		3.00			
Total Dissolved Solids	1200.00		10.00	1010.00		5.00		500.00	
Sulfate	15.00		0.05	241.00		5.00		250.00	
Total Organic Carbon	52.00		1.00	33.00		1.00			
TOC (Duplicate)	52.00		1.00	33.30		1.00			
Total Organic Halogens	0.86		0.01	0.03		0.01			
Magnesium		NS			NS				
Mangenese		NS			NS			0.05	
Potassium		NS			NS				
Sodium		NS			NS		160.00		
Alkalinity		NS			NS				
Calcium		NS			NS				
Hardness		NS			NS				
Boron		NS			NS				0.63
Specific Conductance (umho/cm)		NS			NS				

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.25: Characteristics of the Massachusetts Site.

LANDFILL:	Massachusetts Site
OWNER/OPERATOR:	Unknown.
LITERATURE SOURCE:	Construction and Demolition Landfill Leachate Characterization Study Prepared by Rust Environments & Infrastructure for WMX Technologies, Inc.
WASTE TYPE:	Construction waste and demolition debris. Includes wood, plaster, roofing materials, fencing, telephone poles, tires, and appliances. Does not accept special waste such as asbestos.
ACREAGE:	4 acres.
YEARS IN SERVICE:	Opened in November 1989.
LINER SYSTEM:	60-mil HDPE liner.
LEACHATE SYSTEM:	Yes.
LEACHATE SAMPLE:	Leachate sample taken from a composite of two leachate tanks which drain the three active landfill cells.
MISCELLANEOUS:	Waste Management reported the analytical results from this landfill, but did not identify the location or the owner/operators of the landfill.

Table A.26: Sampling for the Massachusetts Site.

	1991 Sampling Result		Det Limit	1992 Sampling Result		Det Limit	1993 Sampling Result		Det Limit	Primary MCL	Secondary MCL	Guidance Conc
Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acetone	5100.00		250.00		ND	680.00	41.00		10.00			700.00
2-Butanone	2500.00		250.00		ND			ND				4200.00
Carbon Disulfide		ND	12.00		ND	100.00		ND	5.00			700.00
Chloromethane	43.00		25.00		ND	200.00		ND	10.00			2.70
1,1-Dichloroethane	48.00		12.00		ND	100.00		ND	5.00			700.00
1,2-Dichloroethane	26.00		12.00		ND	100.00		ND	5.00	3.00		
1,4-Dioxane		ND	10.00		ND		49.00		20.00			5.00
Ethylbenzene	18.00		12.00		ND	100.00	1.00		5.00		700.00	
Methyl Ethyl Ketone (MEK)	2500.00		250.00	390.00		200.00		ND	10.00			4200.00
4-Methyl-2-Pentanone	250.00		120.00		ND	200.00		ND	10.00			
Methylene Chloride	60.00		12.00		ND	100.00		ND	5.00	5.00		
Toluene	240.00		12.00	290.00		100.00		ND	5.00	1000.00		
1,1,1 Trichloroethane		NS			NS			NS		200.00		
Trichloroethylene	20.00		12.00		ND	100.00		ND	5.00	3.00		
Trichlorofluoromethane		ND	25.00		ND	100.00		ND	10.00			2100.00
Xylenes (Total)	85.00		12.00	120.00		100.00	4.00		5.00	10000.00		
Semi-Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acenaphthene		ND	47.00		ND	100.00		ND	10.00			20.00
Acetophenone		ND	47.00		ND	100.00	2.00		10.00			700.00
Benzene		ND	12.00		ND	5.00		ND	5.00	1.00		
Benzoic Acid	53000.00	ND	240.00		NS			ND	50.00			28000.00
Bis(2-Ethylhexyl)phthalate		ND	47.00		ND	500.00		ND	10.00			
2,4-Dimethylphenol		ND	47.00		ND	100.00		ND	10.00			400.00
Di-n-Butyl phthalate		ND	47.00		ND	100.00		ND	10.00			700.00
Diethyl Phthalate		ND	47.00		ND	100.00	1.00		10.00			5600.00
Fluoranthene		ND	47.00		ND	100.00		ND	10.00			280.00
Napthalene	63.00		47.00		ND	100.00		ND	10.00			6.80
m&p-Creosol	5700.00		47.00	3200.00		100.00		ND	10.00			35.00
o-Creosol	64.00		47.00		ND	100.00		ND	10.00			350.00
Phenathrene		ND	47.00		ND	100.00	3.00		10.00			10.00
Phenol	1900.00	ND	47.00	210.00		100.00		ND	10.00			10.00
Pyrene		ND	47.00		ND	100.00		ND	10.00			210.00
Herbicides/Pesticides	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Alpha-BHC	0.12		0.05		ND	0.80		ND	0.50			0.05
Endrin		ND	0.05		ND	0.80		ND	0.99	2.00		
Dieldrin	0.07		0.05		ND	0.80		ND	0.50			0.10
Dimethoate		ND	1.90		ND	100.00	2.70		1.90			5.00
Disulfoton		ND	1.90		ND	100.00	5.60		1.50			0.50
2,4,5-T	0.53		0.19		ND	2.00		ND	4.70			70.00
2,4-D		ND	1.10		ND	2.00		ND	4.70	70.00		
HxCDD		ND	2.00		ND	360.00		ND	1.90			
HxCDF		ND	1.10		ND	210.00		ND	1.40			
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		ND	7.00		ND	500.00		ND	100.00	6.00		
Arsenic	33.00		4.00		ND	35.00	15.00		30.00	50.00		
Barium	500.00		10.00	368.00		200.00	200.00		50.00	2000.00		
Cadmium		ND	20.00		ND	5.00		ND	10.00	5.00		
Chromium	45.00		10.00		ND	50.00		ND	20.00	100.00		
Copper		ND	80.00		ND	125.00		ND	20.00	1000.00		
Lead	13.00		3.00		ND	25.00		ND	50.00	15.00		
Mercury		ND	0.20		ND	0.20		ND	0.20	2.00		
Nickel		ND	80.00		ND	200.00		ND	20.00	100.00		
Selenium		ND	5.00		ND	5.00		ND	2.00	50.00		
Silver		NS			NS			NS			100.00	
Thallium		ND	5.00		ND	10.00		ND	500.00	2.00		
Vanadium	96.00		20.00		ND	50.00		ND	10.00			49.00
Zinc	300.00		80.00	78.50		20.00	13.00		10.00		5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	110.00		1.00		NS		27.00		2.00			

Cadmium		ND	20.00		ND	5.00		ND	10.00	5.00		
Chromium	45.00		10.00		ND	50.00		ND	20.00	100.00		
Copper		ND	80.00		ND	125.00		ND	20.00	1000.00		
Lead	13.00		3.00		ND	25.00		ND	50.00	15.00		
Mercury		ND	0.20		ND	0.20		ND	0.20	2.00		
Nickel		ND	80.00		ND	200.00		ND	20.00	100.00		
Selenium		ND	5.00		ND	5.00		ND	2.00	50.00		
Silver		NS			NS			NS			100.00	
Thallium		ND	5.00		ND	10.00		ND	500.00	2.00		
Vanadium	96.00		20.00		ND	50.00		ND	10.00			49.00
Zinc	300.00		80.00	78.50		20.00	13.00		10.00		5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	110.00		1.00		NS		27.00		2.00			
Chemical Oxygen Demand	4700.00		200.00	1690.00		200.00	420.00		50.00			
Chlorides	410.00		1.00	493.00		2.50	200.00		20.00		250.00	
Cyanide	0.02		0.01		ND	0.02		ND	0.01	0.20		
Ammonia, Nitrogen	40.00		8.00	42.80		0.40	25.80		1.00			
Organic Nitrogen		NS			NS			NS				
Nitrate		NS			NS			NS		10.00		
Nitrite		NS			NS			NS		1.00		
Iron	27.00		0.04	44.80		0.50	14.00		0.03		0.30	
Oil and Grease	26.00		0.48		ND	2.50		ND	6.00			
pH	6.60			7.18			7.20				6.5-8.5	
Phenols (Total)	4.90		0.20	1.75		0.05	0.04		0.01			
Phosphorus	1.60		0.10	1.42		0.20	0.21		0.05			
Total Suspended Solids	91.00		10.00	78.00		3.00	44.00		5.00			
Total Dissolved Solids	6500.00		9.00	4710.00		5.00	1800.00		10.00		500.00	
Sulfate	21.00		0.05	112.00		50.00	18.90		10.00		250.00	
Total Organic Carbon	2100.00		30.00	550.00		10.00	128.00		10.00			
TOC (Duplicate)	1900.00		30.00	529.00		10.00	128.00		10.00			
Total Organic Halogens	0.91		0.01	0.59		0.01	0.32		0.01			
Magnesium		NS			NS			NS				
Mangenese		NS			NS			NS			0.05	
Potassium		NS			NS			NS				
Sodium		NS			NS			NS		160.00		
Alkalinity		NS			NS			NS				
Calcium		NS			NS			NS				
Hardness		NS			NS			NS				
Boron		NS			NS			NS				0.63
Specific Conductance (umho/cm)		NS			NS			NS				

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.27: Characteristics of the Michigan Site.

LANDFILL:	Michigan Site
OWNER/OPERATOR:	Waste Management of North America, Inc. 3003 Butterfield Road Oak Brook, IL 60521
LITERATURE SOURCE:	Construction and Demolition Landfill Leachate Characterization Study Prepared by Rust Environments & Infrastructure for WMX Technologies, Inc.
WASTE TYPE:	Construction waste and demolition debris. Includes concrete, brick, wooden pallets, and brush. Does not accept white goods or tires.
ACREAGE:	2 acres.
YEARS IN SERVICE:	Opened in June 1990.
LINER SYSTEM:	30-mil PVC liner.
LEACHATE SYSTEM:	Yes.
LEACHATE SAMPLE:	Leachate sample taken from a leachate manhole in the C&D portion of the landfill.
MISCELLANEOUS:	None.

Table A.28: Sampling for the Michigan Site.

	1991 Sampling Result		Det Limit	1992 Sampling Result		Det Limit	1993 Sampling Result		Det Limit	Primary MCL	Secondary MCL	Guidance Conc
Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acetone	160		100.00		ND	34	970		100.00			700
2-Butanone		ND			ND			ND				4200
Carbon Disulfide		ND	5.00		ND	5.00	14		5.00			700
Chloromethane		ND	10.00		ND	10.00		ND	10.00			3
1,1-Dichloroethane		ND	5.00		ND	5	4		5.00			700
1,2-Dichloroethane	9.2		5.00		ND	5		ND	5.00	3		
1,4-Dioxane		ND	10.00		ND			ND	20.00			5
Ethylbenzene		ND	5.00		ND	5		ND	5.00		700	
Methyl Ethyl Ketone (MEK)		ND	100.00		ND	10	470		100.00			4200
4-Methyl-2-Pentanone		ND	50.00		ND	10		ND	10.00			
Methylene Chloride	6		5.00		ND	5	7		5.00	5		
Toluene		ND	5.00		ND	5	110		5.00	1000		
1,1,1 Trichloroethane		NS			NS			NS		200		
Trichloroethylene		ND	5.00		ND	5		ND	5.00	3		
Trichlorofluoromethane	13		10.00		ND	10		ND	10.00			2100
Xylenes (Total)		ND	5.00		ND	10	2		5.00	10000		
Semi-Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acenaphthene		ND	48.00		ND	10.00		ND	10.00			20
Acetophenone		ND	48.00		ND	10.00		ND	10.00			700
Benzene		ND	5.00		ND	5.00		ND	5.00	1		
Benzoic Acid	5500		240.00		NS		11000		500.00			28000
Bis(2-Ethylhexyl)phthalate		ND	48.00		ND	50.00	2		10.00			
2,4-Dimethylphenol		ND	48.00		ND	10.00	15		10.00			400
Di-n-Butyl phthalate		ND	48.00		ND	10.00		ND	10.00			700
Diethyl Phthalate		ND	48.00		ND	10.00	7		10.00			5600
Fluoranthene		ND	48.00		ND	10.00		ND	10.00			280
Napthalene		ND	48.00		ND	10.00	65		10.00			7
m&p-Creosol	190		48.00		ND	10.00	1100		100.00			35
o-Creosol		ND	48.00		ND	10.00		ND	10.00			350
Phenathrene		ND	48.00		ND	10.00		ND	10.00			10
Phenol		ND	48.00		ND	10.00	22		10.00			10
Pyrene		ND	48.00		ND	10.00		ND	10.00			210
Herbicides/Pesticides	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Alpha-BHC		ND	0.940		ND	0.40		ND	0.26			0.05
Endrin		ND	0.940		ND	0.40		ND	0.51	2.0		
Dieldrin		ND	0.940		ND	0.40		ND	0.51			0.10
Dimethoate		ND	0.94		ND	10.00		ND	2.50			5
Disulfoton	0.96		0.94		ND	10.00		ND	1.90			0.5
2,4,5-T		ND	0.19		ND	1.00		ND	4.80			70
2,4-D		ND	1.10		ND	1.00	29		4.80	70		
HxCDD		ND	2.70		ND	68.00	5.5		5.50			
HxCDF		ND	1.60		ND	53.00	7.7		7.70			
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		ND	7.00		ND	100.00		ND	100.00	6		
Arsenic	19		4.00	37.6		10.00	36		10.00	50		
Barium	140		10.00		ND	200.00	510		50.00	2000		
Cadmium	6.9		5.00		ND	5.00		ND	10.00	5		
Chromium		ND	10.00		ND	10.00		ND	20.00	100		
Copper		ND	20.00		ND	25.00		ND	20.00	1000		
Lead		ND	3.00		ND	5.00		ND	50.00	15		
Mercury		ND	0.20		ND	0.20		ND	0.20	2		
Nickel		ND	20.00		ND	40.00		ND	20.00	100		
Selenium		ND	5.00		ND	5.00		ND	10.00	50		
Silver		NS			NS			NS			100	
Thallium		ND	5.00		ND	10.00		ND	50.00	2		
Vanadium		ND	20.00		ND	50.00	16		10.00			49
Zinc	23		20.00	34.8		20.00	38		10.00		5000	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**

Arsenic	19		4.00	37.6		10.00	36		10.00	50		
Barium	140		10.00		ND	200.00	510		50.00	2000		
Cadmium	6.9		5.00		ND	5.00		ND	10.00	5		
Chromium		ND	10.00		ND	10.00		ND	20.00	100		
Copper		ND	20.00		ND	25.00		ND	20.00	1000		
Lead		ND	3.00		ND	5.00		ND	50.00	15		
Mercury		ND	0.20		ND	0.20		ND	0.20	2		
Nickel		ND	20.00		ND	40.00		ND	20.00	100		
Selenium		ND	5.00		ND	5.00		ND	10.00	50		
Silver		NS			NS			NS			100	
Thallium		ND	5.00		ND	10.00		ND	50.00	2		
Vanadium		ND	20.00		ND	50.00	16		10.00			49
Zinc	23		20.00	34.8		20.00	38		10.00		5000	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	140		1.00		NS		920		2.00			
Chemical Oxygen Demand	390		5.00	156		10.00	1300		50.00			
Chlorides	51		0.40	48.2		0.50	130		5.00		250	
Cyanide	0.02		0.01		ND	0.02	0.01		0.01	0.2		
Ammonia, Nitrogen	1.1		0.08	0.74		0.02	5.4		0.20			
Organic Nitrogen		NS			NS			NS				
Nitrate		NS			NS			NS		10		
Nitrite		NS			NS			NS		1		
Iron	1.4		0.04	6.29		0.10	27.6		0.03		0.30	
Oil and Grease	1.1		0.44	4.4		1.00	9		6.00			
pH	7.2			7.15		0.05	6.9				6.5-8.5	
Phenols (Total)	0.14		0.01		ND	0.01	0.35		0.03			
Phosphorus	0.1		0.02	0.26		0.20	0.27		0.05			
Total Suspended Solids		ND	10.00	19		3.00	86		5.00			
Total Dissolved Solids	3000		9.00	1760		5.00	2700		10.00		500	
Sulfate	770		1.00	459		100.00	68.3		25.00		250	
Total Organic Carbon	180		2.00	49.6		1.00	434		50.00			
TOC (Duplicate)	170		2.00	48.7		1.00	436		50.00			
Total Organic Halogens	0.74		0.01	0.07		0.01	0.14		0.01			
Magnesium		NS			NS			NS				
Mangenese		NS			NS			NS			0.050	
Potassium		NS			NS			NS				
Sodium		NS			NS			NS		160		
Alkalinity		NS			NS			NS				
Calcium		NS			NS			NS				
Hardness		NS			NS			NS				
Boron		NS			NS			NS				0.63
Specific Conductance (umho/cm)		NS			NS			NS				

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.29: Characteristics of the Mount Olivet Landfill, Seattle, Washington.

LANDFILL:	Mount Olivet Landfill, Seattle, Washington.
OWNER/OPERATOR:	Fioorillo Northwest, Inc. Post Office Box 66826 Seattle, Washington 98166-0826
LITERATURE SOURCE:	Washington State Department of Ecology Presented in C&D Waste Landfills, Leachate Quality Data, Volume 1. Prepared by Gershman, Brickner & Bratton, Inc. For the National Association of Demolition Contractors.
WASTE TYPE:	Demolition debris and landclearing debris.
ACREAGE:	Unknown.
YEARS IN SERVICE:	Unknown.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	West and East Leachate Ponds.
MISCELLANEOUS:	None.

Table A.30: Sampling for the Mt. Olivet Landfill of Washington.

	1989 East Pond Result		Det Limit	1989 West Pond Result		Det Limit	Primary MCL	Secondary MCL	Guidance Conc
Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acetone	150.00			60.00					700.00
2-Butanone	94.00			14.00					4200.00
Carbon Disulfide	5.60			1.80					700.00
Chloromethane		ND	3.80		ND	3.80			2.70
1,1-Dichloroethane		ND	0.60		ND	0.60			700.00
1,2-Dichloroethane		ND	0.50		ND	0.50	3.00		
1,4-Dioxane		NS			NS				5.00
Ethylbenzene		ND	0.80	0.80				700.00	
Methyl Ethyl Ketone (MEK)		NS			NS				4200.00
4-Methyl-2-Pentanone	8.90				ND	3.50			
Methylene Chloride		ND	3.30		ND	3.30	5.00		
Toluene	1.00		0.80	1.00			1000.00		
1,1,1-Trichloroethane		ND	0.60		ND	0.60	200.00		
Trichloroethylene		NS			NS		3.00		
Trichlorofluoromethane		NS			NS				2100.00
Xylenes (Total)		ND	1.80	23.00			10000.00		
Semi-Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acenaphthene		NS			NS				20.00
Acetophenone		NS			NS				700.00
Benzene		ND	1.00		ND	1.00	1.00		
Benzoic Acid	910.00			210.00					28000.00
Bis(2-Ethylhexyl)phthalate		ND	10.00		ND	10.00			
2,4-Dimethylphenol		ND	20.00		ND	20.00			400.00
Di-n-Butyl phthalate	11.00				ND	10.00			700.00
Diethyl Phthalate		ND	10.00		ND	10.00			5600.00
Fluoranthene		ND	10.00		ND	10.00			280.00
Napthalene		ND	10.00		ND	10.00			6.80
m&p-Creosol	670.00			74.00					35.00
o-Creosol	36.00				ND	10.00			350.00
Phenathrene		ND	10.00		ND	10.00			10.00
Phenol	130.00			17.00					10.00
Pyrene		ND	10.00		ND	10.00			210.00
Herbicides/Pesticides	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Alpha-BHC		NS			NS				0.05
Endrin		NS			NS		2.00		
Dieldrin		NS			NS				0.10
Dimethoate		NS			NS				5.00
Disulfoton		NS			NS				0.50
2,4,5-T		NS			NS				70.00
2,4-D		NS			NS		70.00		
HxCDD		NS			NS				
HxCDF		NS			NS				
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		NS			NS		6.00		
Arsenic		NS			NS		50.00		
Barium		NS			NS		2000.00		
Cadmium		ND	2.00		ND	2.00	5.00		
Chromium		ND	5.00		ND	5.00	100.00		
Copper	8.00			2.00	NS		1000.00		
Lead		ND	30.00		ND	30.00	15.00		
Mercury		NS			NS		2.00		
Nickel	50.00			10.00			100.00		
Selenium		NS			NS		50.00		
Silver		NS			NS			100.00	
Thallium		NS			NS		2.00		
Vanadium		NS			NS				49.00
Zinc	24.00			17.00				5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand		NS			NS				
Chemical Oxygen Demand		NS			NS				

Copper	8.00			2.00	NS		1000.00		
Lead		ND	30.00		ND	30.00	15.00		
Mercury		NS			NS		2.00		
Nickel	50.00			10.00			100.00		
Selenium		NS			NS		50.00		
Silver		NS			NS			100.00	
Thallium		NS			NS		2.00		
Vanadium		NS			NS				49.00
Zinc	24.00			17.00				5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand		NS			NS				
Chemical Oxygen Demand		NS			NS				
Chlorides		NS			NS			250.00	
Cyanide		NS			NS		0.20		
Ammonia, Nitrogen		NS			NS				
Organic Nitrogen		NS			NS				
Nitrate		NS			NS		10.00		
Nitrite		NS			NS		1.00		
Iron		NS			NS			0.30	
Oil and Grease	40.00		10.00	50.00		10.00			
pH		NS			NS			6.5-8.5	
Phenols (Total)		NS			NS				
Phosphorus		NS			NS				
Total Suspended Solids		NS			NS				
Total Dissolved Solids		NS			NS			500.00	
Sulfate		NS			NS			250.00	
Total Organic Carbon		NS			NS				
TOC (Duplicate)		NS			NS				
Total Organic Halogens		NS			NS				
Magnesium		NS			NS				
Mangenese		NS			NS			0.05	
Potassium		NS			NS				
Sodium		NS			NS		160.00		
Alkalinity		NS			NS				
Calcium		NS			NS				
Hardness		NS			NS				
Boron		NS			NS				0.63
Specific Conductance (umho/cm)		NS			NS				

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.31: Characteristics of the 110 Sand Company Clean Fill Landfill of New York.

LANDFILL:	110 Sand Company Clean Fill Landfill, New York.
OWNER/OPERATOR:	Broad Hollow Estates/110 Sand Company 170 Cabot Street West Babylon, New York 11704
LITERATURE SOURCE:	New York State Department of Environmental Conservation Presented in C&D Waste Landfills, Leachate Quality Data, Volume 1. Prepared by Gershman, Brickner & Bratton, Inc. For the National Association of Demolition Contractors.
WASTE TYPE:	Demolition debris and landclearing debris.
ACREAGE:	12.1 acres in Phase V. Capacity 3,300,000 cubic yards.
YEARS IN SERVICE:	Unknown.
LINER SYSTEM:	Double Liner.
LEACHATE SYSTEM:	Yes.
LEACHATE SAMPLE:	Leachate sample taken from leachate collection system.
MISCELLANEOUS:	None.

Table A.32a: Sampling for the 100 Sand Company Clean

	3/19/91			3/13/92			6/11/92			9/11/92			12/16/92			WEST, DEC 85			EAST, DEC 85			WEST, APR 86		
	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit
Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS	
Acetone	31.00		5.00		NS			NS			NS			NS			NS			NS			NS	
2-Butanone		ND	5.00		NS			NS			NS			NS			NS			NS			NS	
Carbon Disulfide		ND	5.00		ND	5.00		NS			NS			NS			NS			NS			NS	
Chloromethane		ND	5.00		ND	10.00		NS			NS			NS			NS			NS			NS	
1,1-Dichloroethane		ND	5.00		ND	5.00		NS			NS			NS			NS			NS			NS	
1,2-Dichloroethane		ND	5.00		ND	5.00		NS			NS			NS			NS			NS			NS	
1,4-Dioxane		NS			NS			NS			NS			NS			NS			NS			NS	
Ethylbenzene		ND	5.00		ND	5.00		NS			NS			NS			NS			NS			NS	
Methyl Ethyl Ketone (MEK)		NS			NS			NS			NS			NS			NS			NS			NS	
4-Methyl-2-Pentanone		ND	5.00		ND	10.00		NS			NS			NS			NS			NS			NS	
Methylene Chloride		ND	5.00		ND	5.00		NS			NS			NS			NS			NS			NS	
Toluene		ND	5.00	1.00				NS			NS			NS			NS			NS			NS	
1,1,1-Trichloroethane		ND	5.00		ND	5.00		NS			NS			NS			ND	1.00		ND	1.00		ND	1.00
Trichloroethylene		NS			NS			NS			NS			NS		2.90				ND	0.10		ND	1.00
Trichlorofluoromethane		NS			NS			NS			NS			NS			NS			NS			NS	
Xylenes (Total)		ND	5.00		ND	5.00		NS			NS			NS			NS			NS			NS	
Semi-Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS	
Acenaphthene	3.00		2.00	4.00				NS			NS			NS			NS			NS			NS	
Acetophenone		NS			NS			NS			NS			NS			NS			NS			NS	
Benzene		ND	2.00	1.00				NS			NS			NS			NS			NS			NS	
Benzoic Acid		ND	2.00		NS			NS			NS			NS			NS			NS			NS	
Bis(2-Ethylhexyl)phthalate		ND	2.00		ND	10.00		NS			NS			NS			NS			NS			NS	
2,4-Dimethylphenol		ND	2.00		ND	10.00		NS			NS			NS			NS			NS			NS	
Di-n-Butyl phthalate		ND	2.00		ND	10.00		NS			NS			NS			NS			NS			NS	
Diethyl Phthalate		ND	2.00		ND	10.00		NS			NS			NS			NS			NS			NS	
Fluoranthene		ND	2.00		ND	10.00		NS			NS			NS			NS			NS			NS	
Napthalene		ND	2.00		ND	10.00		NS			NS			NS			NS			NS			NS	
m&p-Creosol		ND	2.00		ND	10.00		NS			NS			NS			NS			NS			NS	
o-Creosol		ND	2.00		ND	10.00		NS			NS			NS			NS			NS			NS	
Phenanthrene		ND	2.00		ND	10.00		NS			NS			NS			NS			NS			NS	
Phenol		ND	2.00		ND	10.00		NS			NS			NS			NS			NS			NS	
Pyrene		ND	2.00		ND	10.00		NS			NS			NS			NS			NS			NS	
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS	
Alpha-BHC		ND	0.10		ND	0.05		NS			NS			NS			NS			NS			NS	
Endrin		ND			ND	0.10		NS			NS			NS			NS			NS			NS	
Dieldrin		ND	0.10		ND	0.10		NS			NS			NS			NS			NS			NS	
Dimethoate		NS	0.10		NS			NS			NS			NS			NS			NS			NS	
Disulfoton		NS	0.10		NS			NS			NS			NS			NS			NS			NS	
2,4,5-T		NS	0.10		NS			NS			NS			NS			NS			NS			NS	
2,4-D		NS	0.10		NS			NS			NS			NS			NS			NS			NS	
HxCDD		NS	0.10		NS			NS			NS			NS			NS			NS			NS	
HxCDF		NS	0.10		NS			NS			NS			NS			NS			NS			NS	
Heavy Metals	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS	
Antimony		ND	16.00	5.80				NS			NS			NS			NS			NS			NS	
Arsenic	32.00			77.30				NS			NS			NS			ND	5.00		ND	5.00		ND	8.00
Barium	370.00			722.00				NS			NS			NS			NS			NS			NS	
Cadmium		ND	4.00	15.80			3.40				ND	3.00		ND	2.00		ND	1.00		ND	1.00		ND	0.80
Chromium	15.00			41.60				NS			NS			NS			ND	25.00		ND	25.00		ND	25.00
Copper	10.00			14.20				NS			NS			NS			ND	25.00		ND	25.00		ND	16.00
Lead		ND	14.00		ND	10.00		ND	4.20		ND	2.00		ND	2.00		ND	5.00		ND	5.00		ND	4.00
Mercury		ND	0.20		ND	0.20		NS			NS			NS			ND	0.20		ND	0.20		ND	0.40
Nickel		ND	14.00	57.80				NS			NS			NS			NS			NS			NS	
Selenium	5.00				ND	2.00		NS			NS			NS			ND	5.00		ND	5.00		ND	4.00
Silver		ND	14.00		ND	5.00		NS			NS			NS			ND	10.00		ND	10.00		ND	10.00
Thallium		ND	4.00		ND	10.00		NS			NS			NS			NS			NS			NS	
Vanadium		ND	40.00	52.70				NS			NS			NS			NS			NS			NS	
Zinc	91.00			47.90				NS			NS			NS			ND	37.00	100.00				ND	35.00
Conventional Parameters	mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS	
Biological Oxygen Demand	26.00				NS			NS			NS			NS			NS			NS			NS	
Chemical Oxygen Demand	960.00				NS		1100.00			540.00			630.00				NS			NS			NS	
Chlorides	840.00				NS		1300.00			600.00			580.00			200.00			160.00			1140.00		
Cyanide	0.04			0.02				NS			NS			NS			NS			NS			NS	
Ammonia, Nitrogen	120.00				NS		170.00			81.00			91.00			3.47			15.28			20.30		
Organic Nitrogen		ND			NS			NS			NS			NS		0.26			0.04				ND	
Nitrate	0.29				NS			ND	0.30	1.30			0.75				ND	0.10		ND	0.10	0.40		
Nitrite		NS			NS			NS			NS			NS			NS			NS			NS	
Iron	30.00			52.60			14.00			22.00			7.10			12.00			14.00			9.60		
Oil and Grease		NS			NS			NS			NS			NS			NS			NS			NS	
pH		NS			NS			NS			NS			NS		7.29			6.90			6.72		
Phenols (Total)		NS			NS		0.03			0.02			0.04			0.03			0.46			0.02		
Phosphorus		NS			NS			NS			NS			NS			NS			NS			NS	
Total Suspended Solids	87.00				NS			NS			NS			NS			NS			NS			NS	
Total Dissolved Solids	3700.00				NS		4000.00			2400.00			1900.00			1570.00			1150.00			1810.00		
Sulfate	400.00				NS		29.00			200.00			320.00			622.00			870.00			350.00		
Total Organic Carbon	290.00				NS		340.00			180.00			160.00			15.00			60.00			63.00		
TOC (Duplicate)		NS			NS			NS			NS			NS			NS			NS			NS	
Total Organic Halogens		NS			NS			NS			NS			NS			NS			NS			NS	
Magnesium	230.00			203.00			180.00			89.00			110.00				NS			NS			NS	
Manganese	7.30			4.66			3.30			2.60			1.60			31.00			22.00			23.00		
Potassium	210.00			292.00			270.00			120.00			160.00				NS			NS			NS	
Sodium	460.00			546.00			530.00			230.00			290.00				NS			NS			NS	
Alkalinity	1600.00				NS		1800.00			1100.00			940.00			398.00			449.00			54.50		
Calcium	190.00			187.00			160.00			100.00			100.00			200.00			160.00			240.00		
Hardness	1400.00				NS		1100.00			620.00			690.00			900.00			600.00				NS	
Boron		NS			NS			NS			NS			NS			NS			NS			NS	
Specific Conductance (umho/cm)		NS			NS			NS			NS			NS		1940.00			1660.00			2700.00		

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level, Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level, Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

and Company Cleanfill of New York.

	WEST, APR 86		EAST, APR 86			PH III, APR 88			Primary	Secondary	Guidance
Result		Det Limit	Result		Det Limit	Result		Det Limit	MCL	MCL	Conc
	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
	NS			NS			NS				700.00
	NS			NS			NS				4200.00
	NS			NS			NS				700.00
	NS			NS			NS				2.70
	NS			NS			NS				700.00
	NS			NS			NS		3.00		
	NS			NS			NS				5.00
	NS			NS			NS			700.00	
	NS			NS			NS				4200.00
	NS			NS			NS				
	NS			NS			NS		5.00		
	NS			NS			NS		1000.00		
	ND	1.00		ND	1.00		ND	1.00	200.00		
	ND	1.00	3.00				ND	1.00	3.00		
	NS			NS			NS				2100.00
	NS			NS			NS		10000.00		
	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
	NS			NS			NS				20.00
	NS			NS			NS				700.00
	NS			NS			NS		1.00		
	NS			NS			NS				28000.00
	NS			NS			NS				
	NS			NS			NS				400.00
	NS			NS			NS				700.00
	NS			NS			NS				5600.00
	NS			NS			NS				280.00
	NS			NS			NS				6.80
	NS			NS			NS				35.00
	NS			NS			NS				350.00
	NS			NS			NS				10.00
	NS			NS			NS				10.00
	NS			NS			NS				210.00
	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
	NS			NS			NS				0.05
	NS			NS			NS		2.00		
	NS			NS			NS				0.10
	NS			NS			NS				5.00
	NS			NS			NS				0.50
	NS			NS			NS				70.00
	NS			NS			NS		70.00		
	NS			NS			NS				
	NS			NS			NS				
	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
	NS			NS			NS		6.00		
	ND	8.00		ND	8.00	11.00			50.00		
	NS			NS			NS		2000.00		
	ND	0.80		ND	0.80		ND	10.00	5.00		
	ND	25.00		ND	25.00		ND	10.00	100.00		
	ND	16.00	23.00				ND	10.00	1000.00		
	ND	4.00		ND	4.00		ND	5.00	15.00		
	ND	0.40		ND	0.40		ND	0.20	2.00		
	NS			NS			NS		100.00		
	ND	4.00		ND	4.00		ND	5.00	50.00		
	ND	10.00		ND	15.00		ND	10.00		100.00	
	NS			NS			NS		2.00		
	NS			NS			NS				49.00
	ND	35.00		ND	35.00	140.00				5000.00	
	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	mg/l	mg/l
	NS			NS			NS				
	NS			NS			NS				
0			400.00			1400.00				250.00	
	NS			NS			NS		0.20		
[illegible]			41.60			160.00					
	ND			ND		90.00					
[illegible]			0.50			0.04			10.00		
	NS			NS			NS		1.00		
[illegible]			12.00			11.00				0.30	
	NS			NS			NS				
[illegible]			6.84			7.10				6.5-8.5	
[illegible]			0.04			0.06					
	NS			NS			NS				
	NS			NS			NS				
00			3064.00			4340.00				500.00	
0			370.00			89.00				250.00	
[illegible]			96.00			220.00					
	NS			NS			NS				
	NS			NS			NS				
	NS			NS			NS				
0			17.00			3.90				0.05	
	NS			NS			NS				
	NS			NS			NS		160.00		
0			38.20			1400.00					
00			400.00			190.00					
	NS			NS		1170.00					
	NS			NS			NS				0.63
00			4460.00			6600.00					

	PH IV, APR 88			COMP, DEC 88			COMP, MAY 89			COMP, DEC 89			COMP, MAY 90			COMP, JUN 90			PH III, IV: WEST (10/90)			PH III, IV:
	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result
Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l
Acetone		NS			NS			NS			NS			NS			NS			NS		
2-Butanone		NS			NS			NS			NS			NS			NS			NS		
Carbon Disulfide		NS			NS			NS			NS			NS			NS			NS		
Chloromethane		NS			NS			NS			NS			NS			NS			NS		
1,1-Dichloroethane		NS			NS			NS			NS			NS			NS			NS		
1,2-Dichloroethane		NS			NS			NS			NS			NS			NS			NS		
1,4-Dioxane		NS			NS			NS			NS			NS			NS			NS		
Ethylbenzene		NS			NS			NS			NS			NS			NS			NS		
Methyl Ethyl Ketone (MEK)		NS			NS			NS			NS			NS			NS			NS		
4-Methyl-2-Pentanone		NS			NS			NS			NS			NS			NS			NS		
Methylene Chloride		NS			NS			NS			NS			NS			NS			NS		
Toluene		NS			NS			NS			NS			NS			NS			NS		
1,1,1-Trichloroethane		ND	1.00		ND	5.00		ND	5.00		ND	5.00		ND	20.00		ND	10.00		ND	5.00	
Trichloroethylene		ND	1.00		ND	5.00		ND	5.00		ND	5.00		ND	20.00		ND	10.00		ND	5.00	
Trichlorofluoromethane		NS			NS			NS			NS			NS			NS			NS		
Xylenes (Total)		NS			NS			NS			NS			NS			NS			NS		
Semi-Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l
Acenaphthene		NS			NS			NS			NS			NS			NS			NS		
Acetophenone		NS			NS			NS			NS			NS			NS			NS		
Benzene		NS			NS			NS			NS			NS			NS			NS		
Benzoic Acid		NS			NS			NS			NS			NS			NS			NS		
Bis(2-Ethylhexyl)phthalate		NS			NS			NS			NS			NS			NS			NS		
2,4-Dimethylphenol		NS			NS			NS			NS			NS			NS			NS		
Di-n-Butyl phthalate		NS			NS			NS			NS			NS			NS			NS		
Diethyl Phthalate		NS			NS			NS			NS			NS			NS			NS		
Fluoranthene		NS			NS			NS			NS			NS			NS			NS		
Napthalene		NS			NS			NS			NS			NS			NS			NS		
m&p-Creosol		NS			NS			NS			NS			NS			NS			NS		
o-Creosol		NS			NS			NS			NS			NS			NS			NS		
Phenathrene		NS			NS			NS			NS			NS			NS			NS		
Phenol		NS			NS			NS			NS			NS			NS			NS		
Pyrene		NS			NS			NS			NS			NS			NS			NS		
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l
Alpha-BHC		NS			NS			NS			NS			NS			NS			NS		
Endrin		NS			NS			NS			NS			NS			NS			NS		
Dieldrin		NS			NS			NS			NS			NS			NS			NS		
Dimethoate		NS			NS			NS			NS			NS			NS			NS		
Disulfoton		NS			NS			NS			NS			NS			NS			NS		
2,4,5-T		NS			NS			NS			NS			NS			NS			NS		
2,4-D		NS			NS			NS			NS			NS			NS			NS		
HxCDD		NS			NS			NS			NS			NS			NS			NS		
HxCDF		NS			NS			NS			NS			NS			NS			NS		
Heavy Metals	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l
Antimony		NS			NS			NS			NS			NS			NS			NS		
Arsenic	40.00			9.00			37.00			57.00			32.00			63.00			42.00			39.00
Barium		NS			NS			NS			NS			NS			NS			NS		
Cadmium		ND	10.00	12.00				ND	1.00	24.00			14.00			21.00			22.00			
Chromium		ND	10.00	23.00			17.00				ND	50.00		ND	50.00	40.00				ND	40.00	
Copper		ND	10.00	50.00			7.00				ND	6.00	28.00			25.00				ND	20.00	22.00
Lead		ND	5.00		ND	2.00	4.00				ND	2.00	12.00			3.00			29.00			
Mercury		ND	0.20		ND	0.20		ND	0.20		ND	0.20		ND	0.20		ND	0.20		ND	0.80	
Nickel		NS			NS			NS			NS			NS			NS			NS		
Selenium		ND	5.00	3.00			3.00			2.00				ND	2.00		ND	2.00		ND	8.00	
Silver		ND	10.00	16.00			10.00				ND	3.00		ND	5.00	9.00				ND	32.00	
Thallium		NS			NS			NS			NS			NS			NS			NS		
Vanadium		NS			NS			NS			NS			NS			NS			NS		
Zinc	220.00			62.00			35.00			27.00			200.00			27.00			45.00			100.00
Conventional Parameters	mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l
Biological Oxygen Demand		NS			NS		-	NS		130.00			67.00			68.00				NS		
Chemical Oxygen Demand		NS			NS			NS			NS			NS			NS			NS		
Chlorides	740.00			980.00			1000.00			580.00			1000.00			880.00			1100.00			1000.00
Cyanide		NS			NS			NS			NS			NS			NS			NS		
Ammonia, Nitrogen	140.00			130.00			140.00			95.00			110.00			95.00			480.00			460.00
Organic Nitrogen		ND		10.00				ND			ND		190.00				ND			ND		
Nitrate	0.01			0.02			0.02			0.26			0.02				ND	0.20	0.22			0.18
Nitrite		NS			NS			NS			NS			NS			NS			NS		
Iron	23.00			0.72			19.80			33.00			18.00			13.00			4.50			6.50
Oil and Grease		NS			NS			NS			NS			NS			NS			NS		
pH	6.75			7.07			7.40			6.70				NS			NS			NS		
Phenols (Total)	0.08			0.03				ND	0.00		ND	0.01		ND	0.02		ND	0.01	0.06			0.05
Phosphorus		NS			NS			NS			NS			NS			NS			NS		
Total Suspended Solids		NS			NS			NS			NS			NS			NS			NS		
Total Dissolved Solids	4180.00			4340.00			5000.00			3800.00			3800.00			4300.00			4300.00			4300.00
Sulfate	280.00			1100.00			1000.00			170.00			370.00			220.00			48.00			190.00
Total Organic Carbon	260.00			360.00			460.00			620.00			380.00			32.00			400.00			380.00
TOC (Duplicate)		NS			NS			NS			NS			NS			NS			NS		
Total Organic Halogens		NS			NS			NS			NS			NS			NS			NS		
Magnesium		NS			NS			NS			NS			NS			NS			NS		
Mangenese	5.20			8.80			5.07			6.70			4.00			5.00			0.99			1.80
Potassium		NS			NS			NS			NS			NS			NS			NS		
Sodium		NS			NS			NS			NS			NS			NS			NS		
Alkalinity	1500.00			1400.00			1600.00			1800.00			1700.00			2100.00				NS		
Calcium	270.00			270.00			295.00			250.00			120.00			235.00			210.00			210.00
Hardness	1500.00			1700.00			1400.00			1530.00			790.00			1600.00			1400.00			1400.00
Boron		NS			NS			NS			NS			NS			NS			NS		
Specific Conductance (umho/cm)	5950.00			6550.00			1200.00			5000.00				NS			NS			NS		

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

b: Sampling for the 100 Sand Company Cleanfill of New York.

PH III, IV: WEST (10/90)			PH III, IV: EAST(10/90)			PH V: WEST(10/90)			PH V: EAST(10/90)			Primary	Secondary	Guidance
Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	MCL	MCL	Conc
ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
	NS			NS			NS			NS				700.00
	NS			NS			NS			NS				4200.00
	NS			NS			NS			NS				700.00
	NS			NS			NS			NS				2.70
	NS			NS			NS			NS				700.00
	NS			NS			NS			NS		3.00		
	NS			NS			NS			NS				5.00
	NS			NS			NS			NS			700.00	
	NS			NS			NS			NS				4200.00
	NS			NS			NS			NS				
	NS			NS			NS			NS		5.00		
	NS			NS			NS			NS		1000.00		
	ND	5.00		ND	5.00		ND	5.00		ND	5.00	200.00		
	ND	5.00		ND	5.00		ND	5.00		ND	5.00	3.00		
	NS			NS			NS			NS				2100.00
	NS			NS			NS			NS		10000.00		
ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
	NS			NS			NS			NS				20.00
	NS			NS			NS			NS				700.00
	NS			NS			NS			NS		1.00		
	NS			NS			NS			NS				28000.00
	NS			NS			NS			NS				
	NS			NS			NS			NS				400.00
	NS			NS			NS			NS				700.00
	NS			NS			NS			NS				5600.00
	NS			NS			NS			NS				280.00
	NS			NS			NS			NS				6.80
	NS			NS			NS			NS				35.00
	NS			NS			NS			NS				350.00
	NS			NS			NS			NS				10.00
	NS			NS			NS			NS				10.00
	NS			NS			NS			NS				210.00
ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
	NS			NS			NS			NS				0.05
	NS			NS			NS			NS		2.00		
	NS			NS			NS			NS				0.10
	NS			NS			NS			NS				5.00
	NS			NS			NS			NS				0.50
	NS			NS			NS			NS				70.00
	NS			NS			NS			NS		70.00		
	NS			NS			NS			NS				
	NS			NS			NS			NS				
ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
	NS			NS			NS			NS		6.00		
42.00			39.00				ND	71.00	41.00			50.00		
	NS			NS			NS			NS		2000.00		
22.00				ND	2.00	54.00			7.00			5.00		
	ND	40.00		ND	40.00		ND	100.00	15.00			100.00		
	ND	20.00	22.00				ND	50.00	8.60			1000.00		
29.00				ND	20.00	12.00				ND	2.00	15.00		
	ND	0.80		ND	0.80		ND	0.80		ND	0.80	2.00		
	NS			NS			NS			NS		100.00		
	ND	8.00		ND	8.00		ND	20.00		ND	20.00	50.00		
	ND	32.00		ND	32.00		ND	8.00	19.00				100.00	
	NS			NS			NS			NS		2.00		
	NS			NS			NS			NS				49.00
45.00			100.00				ND	70.00	28.00				5000.00	
mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	mg/l	mg/l
	NS			NS			NS			NS				
	NS			NS			NS			NS				
1100.00			1000.00			630.00			580.00				250.00	
	NS			NS			NS			NS		0.20		
480.00			460.00			37.00			250.00					
	ND			ND		21.00				ND				
0.22			0.18			0.17				ND	0.10	10.00		
	NS			NS			NS			NS		1.00		
4.50			6.50			14.00			32.00				0.30	
	NS			NS			NS			NS				
	NS			NS			NS			NS			6.5-8.5	
0.06			0.05			0.33			0.04					
	NS			NS			NS			NS				
	NS			NS			NS			NS				
4300.00			4300.00			4600.00			1400.00				500.00	
48.00			190.00			440.00			360.00				250.00	
400.00			380.00			450.00			240.00					
	NS			NS			NS			NS				
	NS			NS			NS			NS				
	NS			NS			NS			NS				
0.99			1.80			4.60			7.40				0.05	
	NS			NS			NS			NS				
	NS			NS			NS			NS		160.00		
	NS			NS			NS			NS				
210.00			210.00			300.00			170.00					
1400.00			1400.00			2200.00			1400.00					
	NS			NS			NS			NS				0.63
	NS			NS			NS			NS				

Table A.33: Characteristics of the Sanifill Landfills of Houston, Texas.

LANDFILL:	Houston Landfills, Texas.
OWNER/OPERATOR:	Sanifill Inc. Houston, Texas.
LITERATURE SOURCE:	Properties of Leachate from Construction/Demolition Waste Landfills James M. Norstrom, Charles E. Williams, and Paul A. Pabor. In Proceedings Fourteenth Annual Madison Waste Conference, Sept 25-26, 1991.
WASTE TYPE:	Construction waste and demolition debris. Includes in descending order of % volume: wood brush, and grass; concrete, rock, asphalt, and soil; paper and cardboard; metal, rubber, plastic, and glass.
ACREAGE:	Unknown.
YEARS IN SERVICE:	Opened in mid to late 1980's.
LINER SYSTEM:	Yes.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	Leachate sample taken from leachate wells developed at each of the landfills for this study. Approximate depth to the bottom of the wells from the top of the landfills ranged from 23 to 60 feet.
MISCELLANEOUS:	The investigators sampled leachate from three C&D landfills owned by Sanifill and located in Houston Texas. Two samples were taken from each landfill and analyzed for a variety of parameters. Only the minimum and maximum analytical results were presented in the report.

Table A.34: Sampling for the Sanifill Landfills of Houston, Texas.

	Minimum Result		Det Limit	Maximum Result		Det Limit	Primary MCL	Secondary MCL	Guidance Conc
Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acetone		NS			NS				700.00
2-Butanone		NS			NS				4200.00
Carbon Disulfide		NS			NS				700.00
Chloromethane		NS			NS				2.70
1,1-Dichloroethane		NS			NS				700.00
1,2-Dichloroethane		NS			NS		3.00		
1,4-Dioxane		NS			NS				5.00
Ethylbenzene		NS			NS			700.00	
Methyl Ethyl Ketone (MEK)		NS			NS				4200.00
4-Methyl-2-Pentanone		NS			NS				
Methylene Chloride		NS			NS		5.00		
Toluene		NS			NS		1000.00		
1,1,1-trichloroethane		NS			NS		200.00		
Trichloroethylene		NS			NS		3.00		
Trichlorofluoromethane		NS			NS				2100.00
Xylenes (Total)		NS			NS		10000.00		
Semi-Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acenaphthene		NS			NS				20.00
Acetophenone		NS			NS				700.00
Benzene		NS			NS		1.00		
Benzoic Acid		NS			NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS			NS				
2,4-Dimethylphenol		NS			NS				400.00
Di-n-Butyl phthalate		NS			NS				700.00
Diethyl Phthalate		NS			NS				5600.00
Fluoranthene		NS			NS				280.00
Napthalene		NS			NS				6.80
m&p-Creosol		NS			NS				35.00
o-Creosol		NS			NS				350.00
Phenathrene		NS			NS				10.00
Phenol		NS			NS				10.00
Pyrene		NS			NS				210.00
Herbicides/Pesticides	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Alpha-BHC		NS			NS				0.05
Endrin		NS			NS		2.00		
Dieldrin		NS			NS				0.10
Dimethoate		NS			NS				5.00
Disulfoton		NS			NS				0.50
2,4,5-T		NS			NS				70.00
2,4-D		NS			NS		70.00		
HxCDD		NS			NS				
HxCDF		NS			NS				
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		NS			NS		6.00		
Arsenic	17.00			75.00			50.00		
Barium	1500.00			8000.00			2000.00		
Cadmium	20.00			30.00			5.00		
Chromium	100.00			250.00			100.00		
Copper	140.00			490.00			1000.00		
Lead	220.00			2130.00			15.00		
Mercury		ND	2.00	9.00		2.00	2.00		
Nickel		NS			NS		100.00		
Selenium		ND	1.00		ND	1.00	50.00		
Silver		ND	10.00	30.00		10.00		100.00	
Thallium		NS			NS		2.00		
Vanadium		NS			NS				49.00
Zinc	1700.00			8630.00				5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	100.00			320.00					

Barium	1500.00			8000.00			2000.00		
Cadmium	20.00			30.00			5.00		
Chromium	100.00			250.00			100.00		
Copper	140.00			490.00			1000.00		
Lead	220.00			2130.00			15.00		
Mercury		ND	2.00	9.00		2.00	2.00		
Nickel		NS			NS		100.00		
Selenium		ND	1.00		ND	1.00	50.00		
Silver		ND	10.00	30.00		10.00		100.00	
Thallium		NS			NS		2.00		
Vanadium		NS			NS				49.00
Zinc	1700.00			8630.00				5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	100.00			320.00					
Chemical Oxygen Demand	3080.00			11200.00					
Chlorides	125.00			240.00				250.00	
Cyanide		ND	0.10		ND	0.10	0.20		
Ammonia, Nitrogen	30.00			184.00					
Organic Nitrogen		NS			NS				
Nitrate	4.00			13.00			10.00		
Nitrite		ND			ND		1.00		
Iron	29.00			172.00				0.30	
Oil and Grease	18.00			47.00					
pH	6.50			7.30				6.5-8.5	
Phenols (Total)	0.70			2.99					
Phosphorus	2.50			3.89					
Total Suspended Solids	1000.00			43000.00					
Total Dissolved Solids	2412.00			4270.00				500.00	
Sulfate		ND	40.00		ND	40.00		250.00	
Total Organic Carbon	76.00			1080.00					
TOC (Duplicate)		NS			NS				
Total Organic Halogens		NS			NS				
Magnesium	92.00			192.00					
Mangenese	1.00			4.90				0.05	
Potassium	118.00			618.00					
Sodium	256.00			1290.00			160.00		
Alkalinity	1710.00			6520.00					
Calcium	148.00			578.00					
Hardness	597.00			1516.00					
Boron	1.40			3.90					0.63
Specific Conductance (umho/cm)	2920.00			6850.00					

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.35: Characteristics of the SKB Rich Valley Demolition Waste Facility, Minnesota.

LANDFILL:	SKB Rich Valley Demolition Waste Management Facility, Minnesota.
OWNER/OPERATOR:	SKB Demolition Waste Disposal. 251 Starkey Street St. Paul, Minnesota 55107
LITERATURE SOURCE:	Potential for Environmental Impairment at the SKB Rich Valley Demolition Waste Management Facility Prepared by Interpoll Laboratories for SKB Demolition Waste Disposal
WASTE TYPE:	Construction waste and demolition debris. This includes concrete, brick asphalt, stucco, rock/gravel, metal, roofing, wood etc. Garbage, yard wastes, liquids, septic tank pumping, tires, appliances, and fertilizers are prohibited at the facility.
ACREAGE:	69 acres.
YEARS IN SERVICE:	Opened in August 1989.
LINER SYSTEM:	Two foot compacted clay liner with three foot protective drainage layer.
LEACHATE SYSTEM:	Leachate collection system installed consisting of PVC collection pipes and lift station. Leachate disposed of off-site.
LEACHATE SAMPLE:	Leachate sampled from leachate collection system.
MISCELLANEOUS:	Groundwater contamination in the area surrounding the facility existed prior to opening the facility. Notably, drinking water quality criteria for iron, manganese and total dissolved solids were exceeded in baseline groundwater samples.

Table A.36: Sampling for the SKB Rich Valley Landfill of Maryland.

	Spring 1990			Summer 1990			Fall 1990			Spring 1992			Summer 1992			Primary	Secondary	Guidance
	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	MCL	MCL	Conc
Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acetone		ND	10.00		NS			NS			NS			NS				700.00
2-Butanone		NS			NS			NS			NS			NS				4200.00
Carbon Disulfide		NS			NS			NS			NS			NS				700.00
Chloromethane		NS			NS			NS			NS			NS				2.70
1,1-Dichloroethane		ND	1.00		NS			NS			NS			NS				700.00
1,2-Dichloroethane		ND	1.00		NS			NS			NS			NS		3.00		
1,4-Dioxane		NS			NS			NS			NS			NS				5.00
Ethylbenzene		ND	1.00		NS			NS			NS			NS			700.00	
Methyl Ethyl Ketone (MEK)		ND	5.00		NS			NS			NS			NS				4200.00
4-Methyl-2-Pentanone		NS			NS			NS			NS			NS				
Methylene Chloride	5.00				NS			NS			NS			NS		5.00		
Toluene		ND	1.00		NS			NS			NS			NS		1000.00		
1,1,1-Trichloroethane	1.00				NS			NS			NS			NS		200.00		
Trichloroethylene		NS			NS			NS			NS			NS		3.00		
Trichlorofluoromethane	20.00				NS			NS			NS			NS				2100.00
Xylenes (Total)		NS			NS			NS			NS			NS		10000.00		
Semi-Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acenaphthene		NS			NS			NS			NS			NS				20.00
Acetophenone		NS			NS			NS			NS			NS				700.00
Benzene		NS			NS			NS			NS			NS		1.00		
Benzoic Acid		NS			NS			NS			NS			NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS			NS			NS			NS			NS				
2,4-Dimethylphenol		NS			NS			NS			NS			NS				400.00
Di-n-Butyl phthalate		NS			NS			NS			NS			NS				700.00
Diethyl Phthalate		NS			NS			NS			NS			NS				5600.00
Fluoranthene		NS			NS			NS			NS			NS				280.00
Napthalene		NS			NS			NS			NS			NS				6.80
m&p-Creosol		NS			NS			NS			NS			NS				35.00
o-Creosol		NS			NS			NS			NS			NS				350.00
Phenathrene		NS			NS			NS			NS			NS				10.00
Phenol		NS			NS			NS			NS			NS				10.00
Pyrene		NS			NS			NS			NS			NS				210.00
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Alpha-BHC		NS			NS			NS			NS			NS				0.05
Endrin		NS			NS			NS			NS			NS		2.00		
Dieldrin		NS			NS			NS			NS			NS				0.10
Dimethoate		NS			NS			NS			NS			NS				5.00
Disulfoton		NS			NS			NS			NS			NS				0.50
2,4,5-T		NS			NS			NS			NS			NS				70.00
2,4-D		NS			NS			NS			NS			NS		70.00		
HxCDD		NS			NS			NS			NS			NS				
HxCDF		NS			NS			NS			NS			NS				
Heavy Metals	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Antimony		NS			NS			NS			NS			NS		6.00		
Arsenic		ND	4.00	20.00				ND	2.00	5.00			2.00			50.00		
Barium		NS			NS			NS		100.00			160.00			2000.00		
Cadmium	0.10				ND	0.10	0.20			0.10				ND	0.40	5.00		
Chromium		ND	10.00		ND	10.00		ND	10.00		ND	1.00		ND	4.00	100.00		
Copper		ND	10.00		ND	10.00	10.00				ND	10.00		ND	10.00	1000.00		
Lead		ND	1.00		ND	3.00		ND	1.00		ND	0.20		ND	0.20	15.00		
Mercury		ND	0.40		ND	0.20		ND	0.20		ND	0.20	0.30			2.00		
Nickel		NS			NS			NS			NS			NS		100.00		
Selenium		NS			NS			NS			NS			NS		50.00		
Silver		NS			NS			NS			NS			NS			100.00	
Thallium		NS			NS			NS			NS			NS		2.00		
Vanadium		NS			NS			NS			NS			NS				49.00
Zinc	10.00				ND	10.00		ND	10.00	10.00			30.00				5000.00	
Conventional Parameters	mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	mg/l	mg/l

Copper		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]											
Lead		ND	1.00		ND	3.00		ND	1.00		ND	0.20		ND	0.20	15.00		
Mercury		ND	0.40		ND	0.20		ND	0.20		ND	0.20	0.30			2.00		
Nickel		NS			NS			NS			NS			NS		100.00		
Selenium		NS			NS			NS			NS			NS		50.00		
Silver		NS			NS			NS			NS			NS			100.00	
Thallium		NS			NS			NS			NS			NS		2.00		
Vanadium		NS			NS			NS			NS			NS				49.00
Zinc	10.00				ND	10.00		ND	10.00	10.00			30.00				5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand		NS			NS			NS			NS			NS				
Chemical Oxygen Demand		NS			NS			NS		110.00			220.00					
Chlorides	160.00			300.00			460.00			100.00			100.00				250.00	
Cyanide		NS			NS			NS			NS			NS		0.20		
Ammonia, Nitrogen	0.66			1.20			0.82			0.99				ND	50.00			
Organic Nitrogen		NS			NS			NS			NS			NS				
Nitrate	3.50				ND	0.50		ND	0.25	0.28			0.91			10.00		
Nitrite		ND	0.10		ND	0.50		ND	0.25		ND	0.00		ND	0.00	1.00		
Iron	0.02			1.30			0.22			9.50			14.00				0.30	
Oil and Grease		NS			NS			NS			NS			NS				
pH		NS			NS			NS			NS			NS			6.5-8.5	
Phenols (Total)		NS			NS			NS			NS			NS				
Phosphorus		NS			NS			NS			NS			NS				
Total Suspended Solids		ND	4.00	21.00			65.00			23.00			51.00					
Total Dissolved Solids	1700.00			5740.00			4600.00			2000.00			2500.00				500.00	
Sulfate	690.00			1600.00			1700.00			730.00			910.00				250.00	
Total Organic Carbon		NS			NS			NS			NS			NS				
TOC (Duplicate)		NS			NS			NS			NS			NS				
Total Organic Halogens		NS			NS			NS			NS			NS				
Magnesium	90.00			460.00			280.00			130.00			160.00					
Mangenese	0.08			9.80			12.00			3.10			3.90				0.05	
Potassium	5.20			55.00			13.00			14.00			15.00					
Sodium	31.00			370.00			230.00			100.00			95.00			160.00		
Alkalinity	410.00			1450.00			770.00			570.00			790.00					
Calcium	310.00			600.00			520.00			280.00			340.00					
Hardness		NS			NS			NS			NS			NS				
Boron		NS			NS			NS			NS			NS				0.63
Specific Conductance (umho/cm)		NS			NS			NS			NS			NS				

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.37: Characteristics of the South Carolina Landfill.

LANDFILL:	South Carolina Landfill.
OWNER/OPERATOR:	Unknown.
LITERATURE SOURCE:	South Carolina Department of Health and Environmental Control Presented in C&D Waste Landfills, Leachate Quality Data, Volume 1. Prepared by Gershman, Brickner & Bratton, Inc. For the National Association of Demolition Contractors.
WASTE TYPE:	Demolition debris and landclearing debris.
ACREAGE:	Unknown.
YEARS IN SERVICE:	Unknown.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	Unknown.
MISCELLANEOUS:	None.

Table A.38: Sampling for the South Carolina Site.

	1994 Result		Det Limit	Primary MCL	Secondary MCL	Guidance Conc
Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acetone		NS				700.00
2-Butanone		NS				4200.00
Carbon Disulfide		NS				700.00
Chloromethane		NS				2.70
1,1-Dichloroethane		NS				700.00
1,2-Dichloroethane		NS		3.00		
1,4-Dioxane		NS				5.00
Ethylbenzene		NS			700.00	
Methyl Ethyl Ketone (MEK)		NS				4200.00
4-Methyl-2-Pentanone		NS				
Methylene Chloride		NS		5.00		
Toluene		NS		1000.00		
1,1,1 Trichloroethane		NS		200.00		
Trichloroethylene		NS		3.00		
Trichlorofluoromethane		NS				2100.00
Xylenes (Total)		NS		10000.00		
Semi-Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acenaphthene		NS				20.00
Acetophenone		NS				700.00
Benzene		NS		1.00		
Benzoic Acid		NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS				
2,4-Dimethylphenol		NS				400.00
Di-n-Butyl phthalate		NS				700.00
Diethyl Phthalate		NS				5600.00
Fluoranthene		NS				280.00
Napthalene		NS				6.80
m&p-Creosol		NS				35.00
o-Creosol		NS				350.00
Phenathrene		NS				10.00
Phenol		NS				10.00
Pyrene		NS				210.00
Herbicides/Pesticides	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Alpha-BHC		NS				0.05
Endrin		NS		2.00		
Dieldrin		NS				0.10
Dimethoate		NS				5.00
Disulfoton		NS				0.50
2,4,5-T		NS				70.00
2,4-D		NS		70.00		
HxCDD		NS				
HxCDF		NS				
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		NS		6.00		
Arsenic	1.40			50.00		
Barium		NS		2000.00		
Cadmium	1.79			5.00		
Chromium	16.00			100.00		
Copper	9.20			1000.00		
Lead		NS		15.00		
Mercury		NS		2.00		
Nickel		NS		100.00		
Selenium		NS		50.00		
Silver		NS			100.00	
Thallium		NS		2.00		
Vanadium		NS				49.00
Zinc	65.00				5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand		NS				
Chemical Oxygen Demand		NS	5.00			

Cadmium	1.79			5.00		
Chromium	16.00			100.00		
Copper	9.20			1000.00		
Lead		NS		15.00		
Mercury		NS		2.00		
Nickel		NS		100.00		
Selenium		NS		50.00		
Silver		NS			100.00	
Thallium		NS		2.00		
Vanadium		NS				49.00
Zinc	65.00				5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand		NS				
Chemical Oxygen Demand		NS	5.00			
Chlorides	250.00				250.00	
Cyanide		NS		0.20		
Ammonia, Nitrogen		NS				
Organic Nitrogen		NS				
Nitrate		NS		10.00		
Nitrite		NS		1.00		
Iron	0.30				0.30	
Oil and Grease	15.00					
pH		NS			6.5-8.5	
Phenols (Total)		NS				
Phosphorus		NS				
Total Suspended Solids	110.00					
Total Dissolved Solids	8400.00				500.00	
Sulfate	250.00				250.00	
Total Organic Carbon		NS				
TOC (Duplicate)		NS				
Total Organic Halogens		NS				
Magnesium		NS				
Mangenese	0.05				0.05	
Potassium		NS				
Sodium		NS		160.00		
Alkalinity		NS				
Calcium		NS				
Hardness		NS				
Boron		NS				0.63
Specific Conductance (umho/cm)		NS				

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.39: Characteristics of the South Windsor Site of Connecticut.

LANDFILL:	South Windsor Site, Connecticut.
OWNER/OPERATOR:	Unknown.
LITERATURE SOURCE:	Bulky Waste Leachate Characterization Survey Maurice Hamel, Connecticut Department of Environmental Protection Presented in C&D Waste Landfills, Leachate Quality Data, Volume 2. Prepared by Gershman, Brickner & Bratton, Inc. For the National Association of Demolition Contractors.
WASTE TYPE:	Demolition debris and landclearing debris.
ACREAGE:	3 acres.
YEARS IN SERVICE:	Opened between 1969 and 1975.
LINER SYSTEM:	Unknown.
LEACHATE SYSTEM:	Unknown.
LEACHATE SAMPLE:	Leachate sample taken from seep at the base of landfill.
MISCELLANEOUS:	Two samples taken from SW 3 in 1987 by Geotoxi as part of site closures.

Table A.40: Sampling for the South Windsor Bulky Waste Landfill of Connecticut.

	July-1988			August-1988			October-1988			December-1988			Primary	Secondary	Guidance
	Result		Det Limit	Result		Det Limit	Result		Det Limit	Result		Det Limit	MCL	MCL	Conc
Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acetone		NS			NS			NS			NS				700
2-Butanone		NS			NS			NS			NS				4200.00
Carbon Disulfide		NS			NS			NS			NS				700.00
Chloromethane		NS			NS			NS			NS				2.70
1,1-Dichloroethane		NS			NS			NS			NS				700.00
1,2-Dichloroethane		NS			NS			NS			NS		3.00		
1,4-Dioxane		NS			NS			NS			NS				5.00
Ethylbenzene		NS			NS			NS			NS			700.00	
Methyl Ethyl Ketone (MEK)		NS			NS			NS			NS				4200.00
4-Methyl-2-Pentanone		NS			NS			NS			NS				
Methylene Chloride		NS			NS			NS			NS		5.00		
Toluene		NS			NS			NS			NS		1000.00		
1,1,1-trichloroethane		NS			NS			NS			NS		200.00		
Trichloroethylene		NS			NS			NS			NS		3.00		
Trichlorofluoromethane		NS			NS			NS			NS				2100.00
Xylenes (Total)		NS			NS			NS			NS		10000.00		
Semi-Volatiles	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Acenaphthene		NS			NS			NS			NS				20.00
Acetophenone		NS			NS			NS			NS				700.00
Benzene		NS			NS			NS			NS		1.00		
Benzoic Acid		NS			NS			NS			NS				28000.00
Bis(2-Ethylhexyl)phthalate		NS			NS			NS			NS				
2,4-Dimethylphenol		NS			NS			NS			NS				400.00
Di-n-Butyl phthalate		NS			NS			NS			NS				700.00
Diethyl Phthalate		NS			NS			NS			NS				5600.00
Fluoranthene		NS			NS			NS			NS				280.00
Napthalene		NS			NS			NS			NS				6.80
m&p-Creosol		NS			NS			NS			NS				35.00
o-Creosol		NS			NS			NS			NS				350.00
Phenathrene		NS			NS			NS			NS				10.00
Phenol		NS			NS			NS			NS				10.00
Pyrene		NS			NS			NS			NS				210.00
Herbicides/Pesticides	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Alpha-BHC		NS			NS			NS			NS				0.05
Endrin		NS			NS			NS			NS		2.00		
Dieldrin		NS			NS			NS			NS				0.10
Dimethoate		NS			NS			NS			NS				5.00
Disulfoton		NS			NS			NS			NS				0.50
2,4,5-T		NS			NS			NS			NS				70.00
2,4-D		NS			NS			NS			NS		70.00		
HxCDD		NS			NS			NS			NS				
HxCDF		NS			NS			NS			NS				
Heavy Metals	ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ND/NS		ug/l	ug/l	ug/l
Antimony		NS			NS			NS			NS		6.00		
Arsenic		ND			ND			NS			ND		50.00		
Barium	400.00			200.00				NS		200.00			2000.00		
Cadmium	20.00				ND			NS		10.00			5.00		
Chromium		ND			ND			NS		10.00			100.00		
Copper	60.00			20.00				ND		40.00			1000.00		
Lead	80.00			70.00				ND		90.00			15.00		
Mercury		ND			ND			NS			ND		2.00		
Nickel		NS			NS			NS			NS		100.00		
Selenium		ND			ND			NS			ND		50.00		
Silver		ND			ND			NS			ND			100.00	
Thallium		NS			NS			NS			NS		2.00		
Vanadium		NS			NS			NS			NS				49.00
Zinc		NS			NS			NS			NS			5000.00	
Conventional Parameters	mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	ND/NS		mg/l	mg/l	mg/l
Biological Oxygen Demand	21.00			10.00				ND	1.00		ND	1.00			

		ND						NS			ND		50.00		
Barium	400.00			200.00				NS		200.00			2000.00		
Cadmium	20.00				ND			NS		10.00			5.00		
Chromium		ND			ND			NS		10.00			100.00		
Copper	60.00			20.00				ND		40.00			1000.00		
Lead	80.00			70.00				ND		90.00			15.00		
Mercury		ND			ND			NS			ND		2.00		
Nickel		NS			NS			NS			NS		100.00		
Selenium		ND			ND			NS			ND		50.00		
Silver		ND			ND			NS			ND			100.00	
Thallium		NS			NS			NS			NS		2.00		
Vanadium		NS			NS			NS			NS				49.00
Zinc		NS			NS			NS			NS			5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	21.00			10.00				ND	1.00		ND	1.00			
Chemical Oxygen Demand	110.00			35.00			50.00			40.00					
Chlorides	33.00			30.00				NS		37.00				250.00	
Cyanide		ND			ND		0.04			0.02			0.20		
Ammonia, Nitrogen	0.40			1.10			0.80			0.44					
Organic Nitrogen	1.50			0.50			0.20			0.32					
Nitrate		ND		0.01				NS		0.10			10.00		
Nitrite	0.01			0.01			0.01			0.01			1.00		
Iron	13.00			54.00				NS		14.00				0.30	
Oil and Grease		NS			NS			NS			NS				
pH	6.80			6.70			6.70			6.50				6.5-8.5	
Phenols (Total)		NS			NS			NS			NS				
Phosphorus		NS			NS			NS			NS				
Total Suspended Solids	260.00			6.60			140.00			18.00					
Total Dissolved Solids	440.00	NS		580.00	NS		530.00	NS		510.00	NS			500.00	
Sulfate	26.00			55.00			140.00			75.00				250.00	
Total Organic Carbon		NS			NS			NS			NS				
TOC (Duplicate)		NS			NS			NS			NS				
Total Organic Halogens		NS			NS			NS			NS				
Magnesium		NS			NS			NS			NS				
Mangenese	3.40			5.60				NS		3.40				0.05	
Potassium		NS			NS			NS			NS				
Sodium	20.00			28.00			31.00			33.00			160.00		
Alkalinity	320.00			240.00				NS		260.00					
Calcium		NS			NS			NS			NS				
Hardness	320.00			720.00				NS		250.00					
Boron		NS			NS			NS			NS				0.63
Specific Conductance (umho/cm)	570.00			810.00			810.00			760.00					

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

Table A.41: Characteristics of the Wisconsin Site.

LANDFILL:	Wisconsin Site.
OWNER/OPERATOR:	Unknown.
LITERATURE SOURCE:	Construction and Demolition Landfill Leachate Characterization Study Prepared by Rust Environments & Infrastructure for WMX Technologies, Inc.
WASTE TYPE:	Demolition debris and landclearing debris. Includes brick, concrete, wood, metals, and roofing shingles.
ACREAGE:	Unknown. However, capacity is estimated at 50,000 cubic yards.
YEARS IN SERVICE:	Began operations in August 1991.
LINER SYSTEM:	Ten foot thick clay liner with a two foot thick drainage layer.
LEACHATE SYSTEM:	Yes.
LEACHATE SAMPLE:	Taken at the low point of the fill area where leachate collected and was visible.
MISCELLANEOUS:	None.

Table A.42: Sampling for the Wisconsin Site.

	1993 Sampling Result		Det Limit	Primary MCL	Secondary MCL	Guidance Conc
Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
2-Butanone		ND	10.00			4200.00
Carbon Disulfide		ND	5.00			700.00
Chloromethane		ND	10.00			2.70
1,1-Dichloroethane		ND	5.00			700.00
1,2-Dichloroethane		ND	5.00	3.00		
1,4-Dioxane		ND	20.00			5.00
Ethylbenzene		ND	5.00		700.00	
Methyl Ethyl Ketone (MEK)		ND	10.00			4200.00
4-Methyl-2-Pentanone		ND	10.00			
Methylene Chloride		ND	5.00	5.00		
Toluene		ND	5.00	1000.00		
1,1,1 Trichloroethane		NS		200.00		
Trichloroethylene		ND	5.00	3.00		
Trichlorofluoromethane		ND	10.00			2100.00
Xylenes (Total)		ND	5.00	10000.00		
Semi-Volatiles	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Acenaphthene		ND	10.00			20.00
Acetophenone		ND	10.00			700.00
Benzene		ND	5.00	1.00		
Benzoic Acid	17		50.00			28000.00
Bis(2-Ethylhexyl)phthalate	31		10.00			
2,4-Dimethylphenol		ND	10.00			400.00
Di-n-Butyl phthalate	7		10.00			700.00
Diethyl Phthalate		ND	10.00			5600.00
Fluoranthene		ND	10.00			280.00
Napthalene		ND	10.00			6.80
m&p-Creosol		ND	10.00			35.00
o-Creosol		ND	10.00			350.00
Phenathrene		ND	10.00			10.00
Phenol		ND	10.00			10.00
Pyrene		ND	10.00			210.00
Herbicides/Pesticides	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Alpha-BHC		ND	0.040			0.05
Endrin		ND	0.94	2.00		
Dieldrin		ND	0.080			0.10
Dimethoate		ND	2.30			5.00
Disulfoton		ND	1.70			0.50
2,4,5-T		ND	0.44			70.00
2,4-D	2.2		0.44	70.00		
HxCDD		ND	1.40			
HxCDF		ND	0.70			
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		ND	100.00	6.00		
Arsenic	7		2.00	50.00		
Barium	76		50.00	2000.00		
Cadmium		ND	10.00	5.00		
Chromium		ND	20.00	100.00		
Copper		ND	20.00	1000.00		
Lead		ND	50.00	15.00		
Mercury		ND	20.00	2.00		
Nickel		ND	20.00	100.00		
Selenium		ND	20.00	50.00		
Silver		NS			100.00	
Thallium		ND	50.00	2.00		
Vanadium		ND	10.00			49.00
Zinc	400		10.00		5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	13		2.00			

HxCDF		ND	[illegible]			
Heavy Metals	**ug/l**	**ND/NS**		**ug/l**	**ug/l**	**ug/l**
Antimony		ND	100.00	6.00		
Arsenic	7		2.00	50.00		
Barium	76		50.00	2000.00		
Cadmium		ND	10.00	5.00		
Chromium		ND	20.00	100.00		
Copper		ND	20.00	1000.00		
Lead		ND	50.00	15.00		
Mercury		ND	20.00	2.00		
Nickel		ND	20.00	100.00		
Selenium		ND	20.00	50.00		
Silver		NS			100.00	
Thallium		ND	50.00	2.00		
Vanadium		ND	10.00			49.00
Zinc	400		10.00		5000.00	
Conventional Parameters	**mg/l**	**ND/NS**		**mg/l**	**mg/l**	**mg/l**
Biological Oxygen Demand	13		2.00			
Chemical Oxygen Demand	220		50.00			
Chlorides	59		5.00		250.00	
Cyanide		ND	0.01	0.20		
Ammonia, Nitrogen	2.4		0.10			
Organic Nitrogen		NS				
Nitrate		NS		10.00		
Nitrite		NS		1.00		
Iron	3.1		0.03		0.30	
Oil and Grease		ND	6.00			
pH	7.6				6.5-8.5	
Phenols (Total)	0.02		0.01			
Phosphorus	0.43		0.05			
Total Suspended Solids	67		5.00			
Total Dissolved Solids	1400		10.00		500.00	
Sulfate	630		25.00		250.00	
Total Organic Carbon	63		20.00			
TOC (Duplicate)	49.6		20.00			
Total Organic Halogens	0.08		0.01			
Magnesium		NS				
Mangenese		NS			0.05	
Potassium		NS				
Sodium		NS		160.00		
Alkalinity		NS				
Calcium		NS				
Hardness		NS				
Boron		NS				0.63
Specific Conductance (umho/cm)		NS				

NS - Not Sampled
ND - Not Detected
Det Limit - Sampling Detection Limit
MCL - Maximum Contaminant Level; Enforceable Groundwater Standards
SMCL- Secondary Maximum Contaminant Level; Enforceable Groundwater Standards
Guidance Concentrations- Not Enforceable Standards

APPENDIX B:

TEST METHODS
&
METHOD DETECTION LIMITS

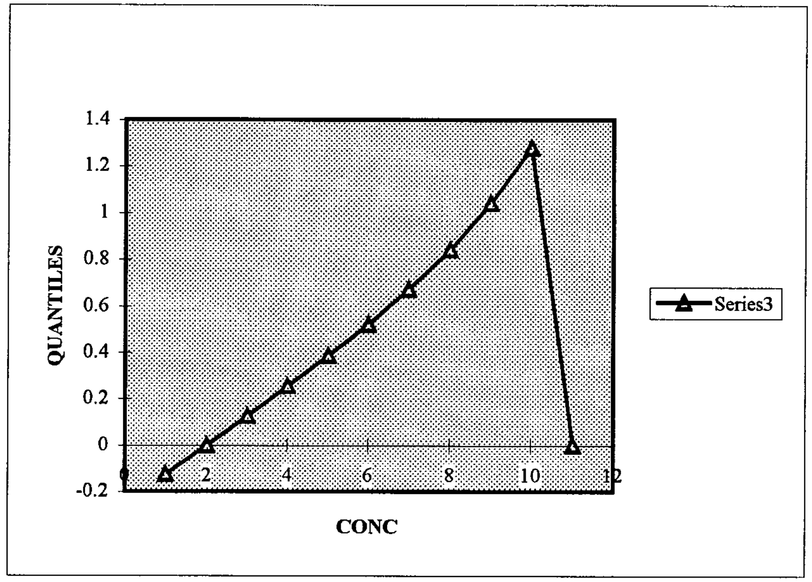
Table B.1: Summary of Test Methods and Method Detection Limits

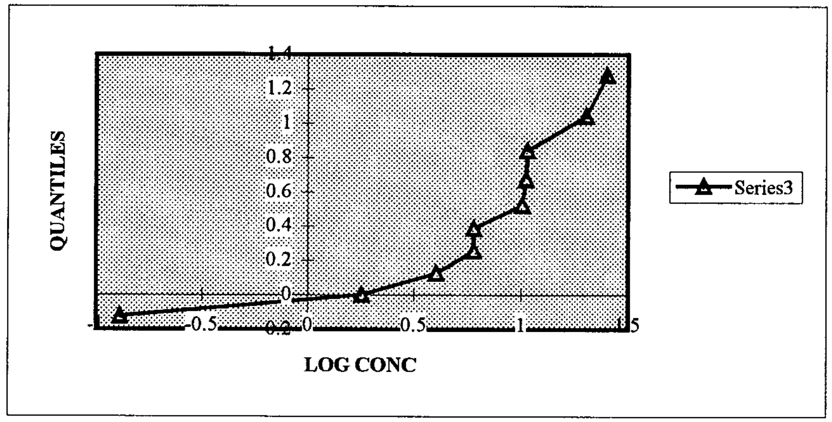
PARAMETER	TEST METHOD	DETECTION LIMIT	SOURCE
Copper	6010: Inductive Coupled Plasma Atomic Emission Spectroscopy	6 ug/l	EPA SW-846
Nickel	6010: Inductive Coupled Plasma Atomic Emission Spectroscopy	15 ug/l	EPA SW-846
Cadmium	6010: Inductive Coupled Plasma Atomic Emission Spectroscopy	4 ug/l	EPA SW-846
Chromium	6010: Inductive Coupled Plasma Atomic Emission Spectroscopy	7 ug/l	EPA SW-846
Silver	6010: Inductive Coupled Plasma Atomic Emission Spectroscopy	7 ug/l	EPA SW-846
Vanadium	6010: Inductive Coupled Plasma Atomic Emission Spectroscopy	8 ug/l	EPA SW-846
Thallium	6010: Inductive Coupled Plasma Atomic Emission Spectroscopy	40 ug/l	EPA SW-846
Nitrate	300.0: Determination of Inorganic Anions by Ion Chromatography	0.42 mg/l	EPA-600
Nitrite	300.0: Determination of Inorganic Anions by Ion Chromatography	0.36 mg/l	EPA-600
Sulfate	300.0: Determination of Inorganic Anions by Ion Chromatography	2.85 mg/l	EPA-600
Antimony	7041: Antimony (Atomic Absorption, Furnace Method)	3.0 ug/l	EPA SW-846
Selenium	7741: Selenium (Gaseous Hydride)	2 ug/l	EPA SW-846
Arsenic	7060: Arsenic (Atomic Absorption, Furnace Method)	1 ug/l	EPA SW-846
Lead	7421: Lead (Atomic Absorption, Furnace Method)	1 ug/l	EPA SW-846
Phenols	8040: Phenols (Gas Chromatography)	1.4 ug/l	EPA SW-846
Total Organic Carbon	9060: Total Organic Carbon	1 mg/l	EPA SW-846
Cyanide	9010: Total Cyanide (Manual, Colorimetric)	5 ug/l	EPA SW-846
Oil and Grease	9070: Oil and Grease	5 mg/l	EPA SW-846
Biological Oxygen Demand	405.1: Biological Oxygen Demand (5 day, 20 degrees C)	2 mg/l	EPA-600
Chemical Oxygen Demand	410.2: Chemical Oxygen Demand (Titrimetric, Low Level)	5 mg/l	EPA-600
Mercury	245.2: Mercury (Automated Cold Vapor Technique)	.2 ug/l	EPA-600
Ammonia	350.2: Nitrogen, Ammonia (Colorimetric)	.05 mg/l	EPA-600

APPENDIX C:

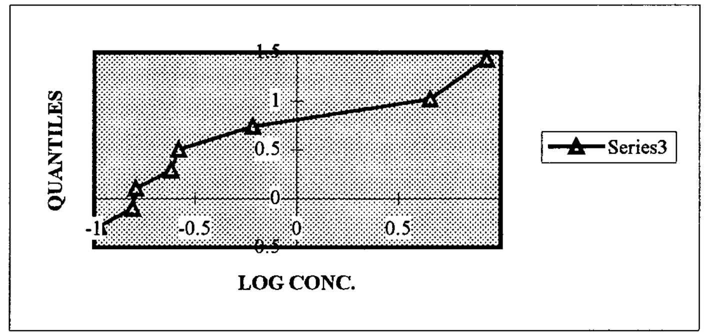
PROBABILITY PLOTS

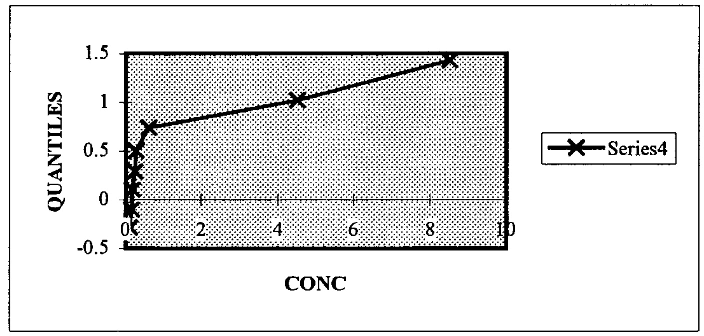
Cadmium				
ug/l	Log	Rank	Prob	Quantiles
0		1	0.05	-1.645
0		2	0.1	-1.28
0		3	0.15	-1.04
0		4	0.2	-0.84
0		5	0.25	-0.67
0		6	0.3	-0.52
0		7	0.35	-0.385
0		8	0.4	-0.255
0.13	-0.88606	9	0.45	-0.125
1.79	0.252853	10	0.5	0
4	0.60206	11	0.55	0.125
6	0.778151	12	0.6	0.255
6	0.778151	13	0.65	0.385
10.05	1.002166	14	0.7	0.52
10.5	1.021189	15	0.75	0.67
10.66667	1.028029	16	0.8	0.84
20	1.30103	17	0.85	1.04
25	1.39794	18	0.9	1.28



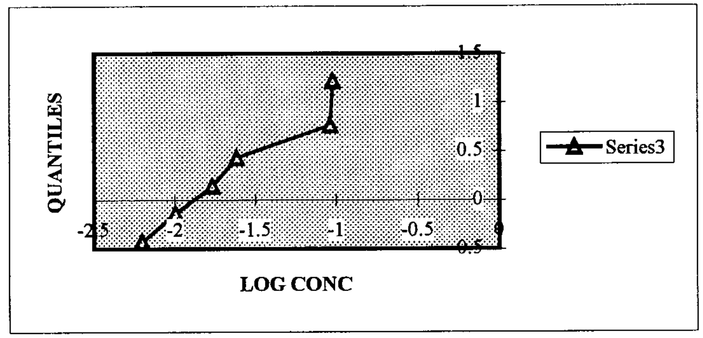


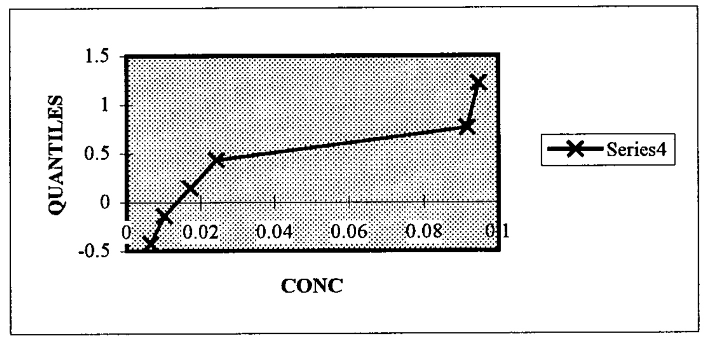
Nitrate				
mg/l	Log	Rank	Prob	Quantiles
0		1	0.076923	-1.43
0		2	0.153846	-1.02
0		3	0.230769	-0.74
0		4	0.307692	-0.5
0.105	-0.97881	5	0.384615	-0.29
0.155	-0.80967	6	0.461538	-0.1
0.16	-0.79588	7	0.538462	0.1
0.24	-0.61979	8	0.615385	0.29
0.260529	-0.58414	9	0.692308	0.5
0.6	-0.22185	10	0.769231	0.74
4.5	0.653213	11	0.846154	1.02
8.5	0.929419	12	0.923077	1.43



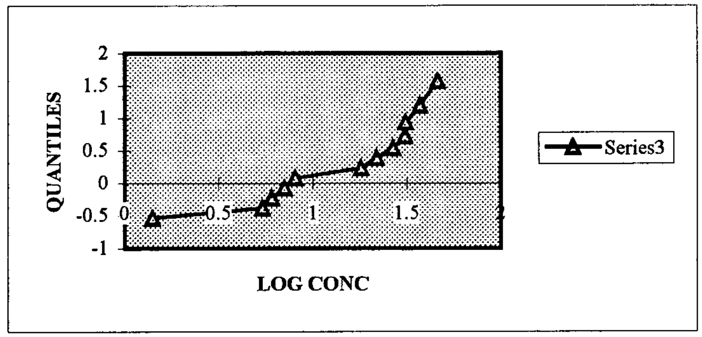


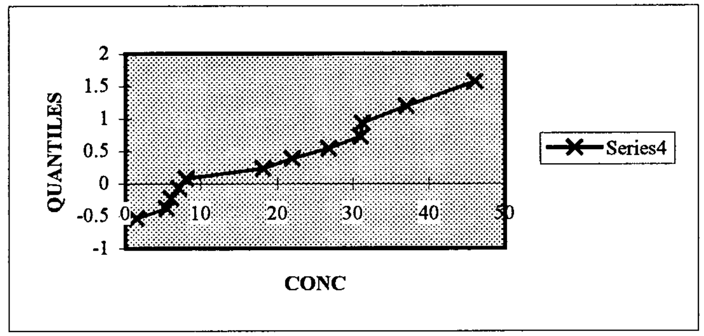
Nitrite				
mg/l	Log	Rank	Prob	Quantile
0		1	0.111111	-1.22
0		2	0.222222	-0.765
0.00625	-2.20412	3	0.333333	-0.43
0.01	-2	4	0.444444	-0.14
0.017	-1.76955	5	0.555556	0.14
0.024	-1.61979	6	0.666667	0.43
0.0915	-1.03858	7	0.777778	0.765
0.0945	-1.02457	8	0.888889	1.22



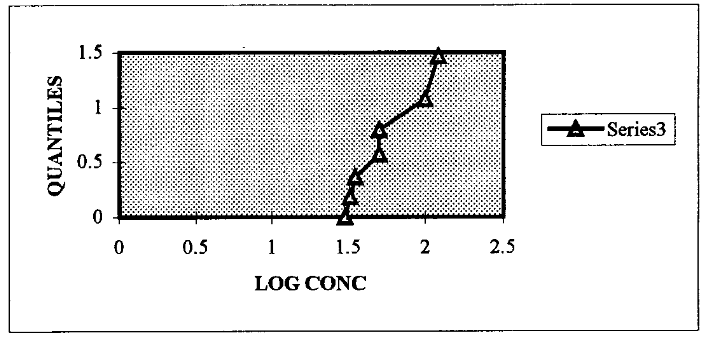


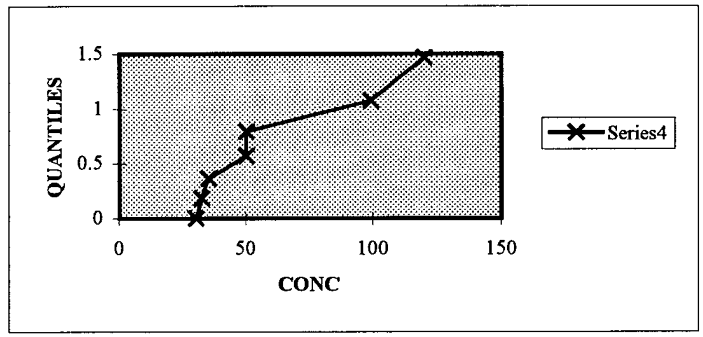
Arsenic				
ug/l	log	Rank	Prob	Quantile
0		1	0.058824	-1.57
0		2	0.117647	-1.19
0		3	0.176471	-0.93
0		4	0.235294	-0.72
1.4	0.146128	5	0.294118	-0.54
5.375	0.730378	6	0.352941	-0.38
6	0.778151	7	0.411765	-0.23
7	0.845098	8	0.470588	-0.075
8	0.90309	9	0.529412	0.075
18	1.255273	10	0.588235	0.23
21.83	1.33912	11	0.647059	0.38
26.65	1.425697	12	0.705882	0.54
30.87	1.48949	13	0.764706	0.72
31.10588	1.492843	14	0.823529	0.93
37	1.568202	15	0.882353	1.19
46	1.662758	16	0.941176	1.57



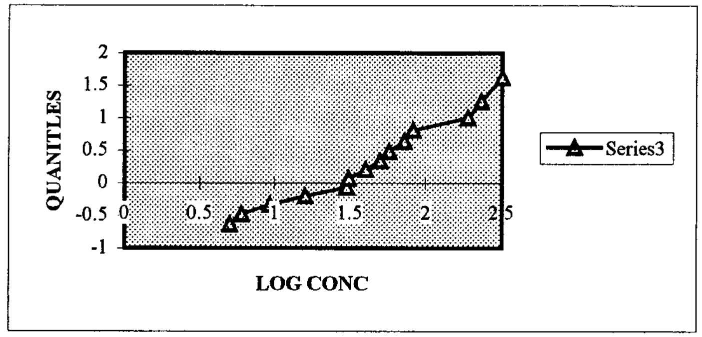


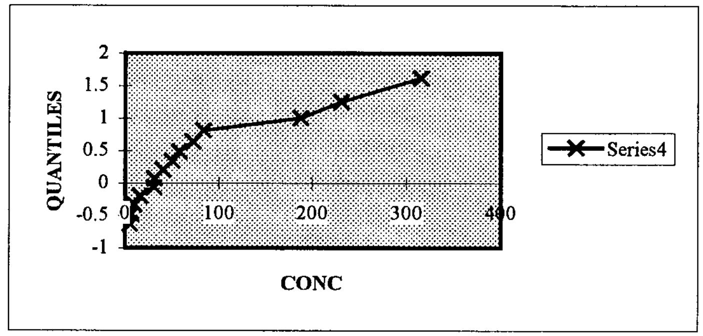
Nickel				
ug/l	Log	Rank	Prob	Quantile
0		1	0.071429	-1.465
0		2	0.142857	-1.07
0		3	0.214286	-0.79
0		4	0.285714	-0.57
0		5	0.357143	-0.365
0		6	0.428571	-0.18
30	1.477121	7	0.5	0
32.4	1.510545	8	0.571429	0.18
34.95	1.543447	9	0.642857	0.365
50	1.69897	10	0.714286	0.57
50	1.69897	11	0.785714	0.79
99	1.995635	12	0.857143	1.07
120	2.079181	13	0.928571	1.465



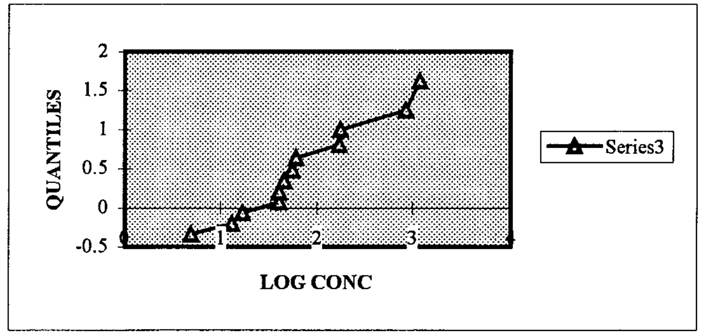


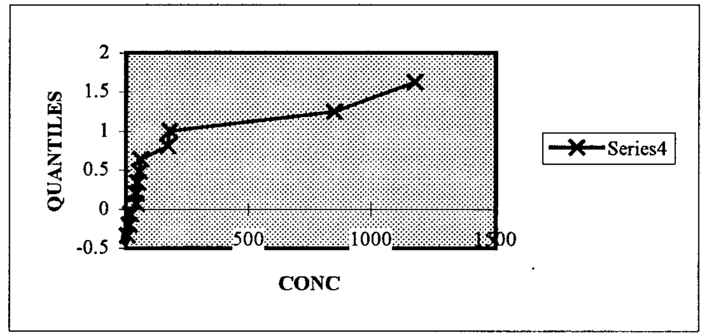
Copper				
ug/l	log	Rank	prob	quantile
0		1	0.052632	-1.62
0		2	0.105263	-1.25
0		3	0.157895	-1
0		4	0.210526	-0.805
5	0.69897	5	0.263158	-0.635
6	0.778151	6	0.315789	-0.48
9.2	0.963788	7	0.368421	-0.34
15.81176	1.19898	8	0.421053	-0.2
30	1.477121	9	0.473684	-0.065
30.75	1.487845	10	0.526316	0.065
40	1.60206	11	0.578947	0.2
50	1.69897	12	0.631579	0.34
57	1.755875	13	0.684211	0.48
72	1.857332	14	0.736842	0.635
82.5	1.916454	15	0.789474	0.805
187.5	2.273001	16	0.842105	1
230	2.361728	17	0.894737	1.25
315	2.498311	18	0.947368	1.62





Lead				
ug/l	log	Rank	prob	quantile
0		1	0.052632	-1.62
0		2	0.105263	-1.25
0		3	0.157895	-1
0		4	0.210526	-0.805
0		5	0.263158	-0.635
0		6	0.315789	-0.48
4.905	0.690639	7	0.368421	-0.34
13	1.113943	8	0.421053	-0.2
16.83333	1.22617	9	0.473684	-0.065
40	1.60206	10	0.526316	0.065
40	1.60206	11	0.578947	0.2
45	1.653213	12	0.631579	0.34
55	1.740363	13	0.684211	0.48
60.125	1.779055	14	0.736842	0.635
170	2.230449	15	0.789474	0.805
176.75	2.247359	16	0.842105	1
845	2.926857	17	0.894737	1.25
1175	3.070038	18	0.947368	1.62





APPENDIX D:

STATISTICAL TESTS

Confidence Intervals for Various Parameters: Using Standard Student T-Tests.

Statistics	Chlorides		Iron		pH		TDS		Mangenese		Sodium		Barium		Zinc		Sulfate	
	mg/l	ND/NS	mg/l	ND/NS	mg/l	ND/NS	mg/l	ND/NS	mg/l	ND/NS	mg/l	ND/NS	ug/l	ND/NS	ug/l	ND/NS	mg/l	ND/NS
	112.20		37.30		6.82		1105.00			NS		NS	328.00		1565.00		128.00	
	367.67		28.60		6.99		4336.67			NS		NS	356.00		130.50		50.63	
	76.40		11.76		7.08		2486.67			NS		NS	250.00		31.93		432.43	
	59.00		3.10		7.60		1400.00			NS		NS	76.00		400.00		630.00	
	100.00		46.00		6.46		1606.00		2.20		100.00		1000.00		84.00		380.00	
	248.00		5.01			NS	3308.00		5.78		165.20		130.00		12.00		1126.00	
	90.75		46.50		6.60		510.00		3.65		42.00		215.00			NS	43.11	
	52.50		7.20		6.95		450.00		3.45		33.00		80.00		70.00		80.50	
	19.00		11.90		6.98		687.50		1.34		56.50		400.00		70.00	NS	45.00	
	33.33		27.00		6.68		515.00		4.13		28.00		266.67			NS	74.00	
	11.50		2.50		6.45		420.00		3.45		14.00		200.00			NS	120.00	
	56.70		0.05		7.24			NS	0.02		64.00			NS		NS	118.00	
		NS		NS		NS		NS		NS		NS		NS	20.50			NS
	367.63		28.13		6.60		1320.00		76.38		101.98			NS		NS	189.43	
	795.26		275.11		6.97		3366.00		8.30		411.20		546.00		71.26		390.95	
	250.00		0.30			NS	8400.00		0.05			NS		NS	403.00		250.00	
	153.00		49.10			NS		NS		NS		NS		NS	135.00			NS
	39.80		48.50			NS		NS		NS		NS		NS	65.00			NS
	27.50		1.15		7.60		1770.00			NS		NS		NS	1150.00			NS
	110.00		5.53			NS	3450.00		1.50			NS	4750.00		5165.00			NS
	182.50		100.50		6.90		3341.00		2.95		773.00			NS	1150.00		1.43	ND
Average	157.64		36.76		6.93		2263.05		8.71		162.63		661.36		657.70		253.72	
Std Dev	184.77		61.53		0.36		2028.49		20.46		231.19		1252.25		1297.07		292.18	
Sample No.	20.00		20.00		15.00		17.00		13.00		11.00		13.00		16.00		16.00	
Degrees of Freedom	19.00		19.00		14.00		16.00		12.00		10.00		12.00		15.00		15.00	
$t_{(0.99,n-1)}$	2.54		2.54		2.62		2.58		2.68		2.76		2.68		2.60		2.60	
$t_{(0.99,n-1)}$*S/(n)^.5	104.90		34.93		0.24		1270.79		15.21		192.67		931.15		843.74		190.06	
Lower Limit of C.I.	52.74		1.83		6.69		992.26		0.00		0.00		0.00		0.00		0.00	
Upper Limit of C. I.	262.54		71.70		7.17		3533.84		23.92		355.30		1592.51		1501.44		443.78	
MCL, SMCL or Guidance	250.00		0.30		6.5-8.5		500.00		0.05		160.00		2000.00		5000.00		250.00	
Problem	Yes		Yes		No		Yes		Yes		Yes		No		No		Yes	

Confidence Intervals for Various Parameters: Calculated by Cohen's Method

Statistics	Cyanide		Arsenic		Nitrate			Nitrite			Copper			Lead			Nickel		
	mg/l	ND/NS	ug/l	ND/NS	mg/l	ND/NS	Log (y)	mg/l	ND/NS	Log (y)	ug/l	ND/NS	Log (y)	ug/l	ND/NS	Log (y)	ug/l	ND/NS	Log (y)
	0.01		26.65			NS			NS		82.50			845.00		2.93	34.95		1.54
	0.01		21.83			NS			NS			ND		16.83		1.23		ND	
	0.01		30.87			NS			NS			ND			ND			ND	
		ND	7.00			NS			NS			ND			ND			ND	
		NS	8.00			ND			ND			ND			ND			ND	
		NS	6.00			NS			NS		6.00		0.78		ND			NS	
	0.09			ND		ND		0.09		-1.04	50.00		1.70	55.00		1.74		NS	
		ND		ND	0.60		-0.22	0.02		-1.62	40.00		1.60	40.00		1.60	50.00		1.70
	0.01		5.38		4.50		0.65	0.02		-1.77	187.50		2.27	45.00		1.65	50.00		1.70
	0.02			ND	0.11		-0.98	0.01		-2.20	30.75		1.49	60.13		1.78		NS	
	0.05			ND	0.16		-0.81	0.09		-1.02	30.00		1.48		ND			ND	
		NS		NS		NS			NS			NS			NS			NS	
		NS		NS		NS			NS		5.00		0.70		ND		30.00		1.48
		NS		NS	0.16		-0.80		NS			NS		176.75		2.25		NS	
	0.03		31.11		0.26		-0.58		NS		15.81		1.20	4.91		0.69	32.40		1.51
		NS	18.00			NS			NS		72.00		1.86	13.00		1.11		ND	
		ND	37.00			ND			NS		57.00		1.76	40.00		1.60	99.00		2.00
		ND	1.40			ND			NS		9.20		0.96		NS			NS	
		NS		NS		NS			NS		230.00		2.36	170.00		2.23	120.00		2.08
		NS	46.00		0.24		-0.62	0.01		-2.00	315.00		2.50	1175.00		3.07		NS	
		ND			8.50		0.93		ND										
Mean of Detects	0.0281		19.9359		-0.3034			-1.6094			1.5886			1.8235			1.7148		
Variance of Detects	0.000729		211.5282		0.510792			0.239976			0.334942			0.490556			0.056619		
No. of ND	5		4		4			2			4			6			6		
No. of Detected	8		12		8			6			13			12			7		
Total Sampled	13		16		12			8			17			18			13		
Percentage of ND	0.385		0.250		0.333			0.250			0.235			0.333			0.462		
gamma=s^2/(mean-DL)^2	1.363		0.590		95.037			0.177			0.510			0.148			0.195		
Detection Limit (DL)	0.005		1		-0.37675	(.42 mg/l)		-0.4437	(.36 mg/l)		0.778151	(6.0 ug/l)		0	(1.0 ug/l)		1.176091	(15.0 ug/l)	
Cohen's Parameter	0.7853		0.4045		0.5519			0.34865			0.34765			0.4813			0.7678		
Corrected Mean	0.009965		12.27633		-0.3439			-1.203			1.306864			0.945858			1.301188		
Corrected Std Dev	0.033891		18.88304		0.716769			0.84485			0.750535			1.446023			0.528651		
Degrees of Freedom	12		15		11			7			16			17			12		
t(0.99,n-1)	2.681		2.602		2.718			2.998			2.583			2.567			2.681		
t(0.99,n-1)*S/(n)^.5	0.025201		12.28342		0.562391			0.895501			0.470187			0.874913			0.393092		
Lower Limit of C.I.	-0.01524		-0.00708		-0.90629	0.124082		-2.0985	0.007971		0.836677	6.865575		0.070945	1.177458		0.908096	8.092749	
Upper Limit of C. I.	0.035166		24.55975		0.218491	1.653831		-0.3075	0.492608		1.777051	59.84825		1.820771	66.18677		1.694281	49.46302	
MCL, SMCL or Guidance	0.2		50			10			1			1000			15			100	
Problem	No		No			No			No			No			Yes			No	

Confidence Interval for Cadmium: Using Aitchinson's Method.

Statistics	Cadmium	
	ug/l	ND/NS
		ND
		ND
		ND
		ND
		ND
	0.13	
	4.00	
	6.00	
	10.50	
	10.67	
	6.00	
		NS
		ND
	512.88	
	10.05	
		ND
		ND
	1.79	
	20.00	
	25.00	
No. of ND (d)	8	
No. of Detects	11	
Total Sampled (n)	19	
Mean of Detected Values	55.18	
Variance of Detected Values	23098.54	
Adjusted Mean	31.94798	
Adjusted Variance	13616.07	
Adjusted Std Dev	116.6879	
Degrees of Freedom	18	
t(0.99,n-1)	2.552	
t(0.99,n-1)*S/(n)^.5	68.31715	
Lower Limit of C.I.	-36.3692	
Upper Limit of C. I.	100.2651	
MCL, SMCL or Guidance	5	
Problem	Yes	

Nonparmetric Confidence Intervals for Selected Compounds

Statistics	Chromium		Mercury		Silver	
	ug/l	ND/NS	ug/l	ND/NS	ug/l	Rank
	0.00	1	0	1	0	1
	0.00	2	0	2	0	2
	0.00	3	0	3	0	3
	0.00	4	0	4	0	4
	0.00	5	0	5	0	5
	0.00	6	0	6	0	6
	0.00	7	0.00	7	0	7
	0.00	8	0	8	0	8
	0.00	9	0	9	0	9
	0.00	10	0	10	10.35	10
	5.67	11	0	11	17.5	11
	14.25	12	0.16	12		
	16.00	13	0.5	13		
	20.68	14	0.5	14		
	20.80	15	5	15		
	26.67	16				
	61.17	17				
	175.00	18				
M**=		15		13		10
n+1-M=		4		3		2
Confidence Interval=		(0, 20.80)		(0, 0.5)		(0, 10.35)
MCL (ug/l)=		100		2		100*
Potential Risk?		No		No		No

* This is a Secondary Drinking Water Limit

** M= n/2 +1 +$z_{0.99}$(n/4)^.5, from the Statistical Analysis of Ground-Water Monitoring Data, EPA , Office of Solid Waste